PIT AND QUARRY

APRIL, 1938

Phosphate Recovery by Flotation . . . A Flexible California Gravel Operation
New Plant Produces Lightweight Slag . . . Merchandising Ready-Mixed Concrete

Read the Answers

Why Other Dealers Are Going Into "Ready Mixed":

- Because the ready-mixed concrete business grew right thru the depression and has one of the brightest futures in America today.
- Because there is a better profit in selling ready-mixed concrete than in selling bulk sand, stone and cement.
- Because it keeps your men, trucks and equipment working profitably the year 'round.
- Because it improves your service, brings you new customers, increases your volume on allied lines.
- Because anyone who owns trucks needs but a small additional investment in loading plant and mixers — and it is very easy to expand facilities as needed.

Why Most Successful Plants Buy Jaeger Truck Mixers:

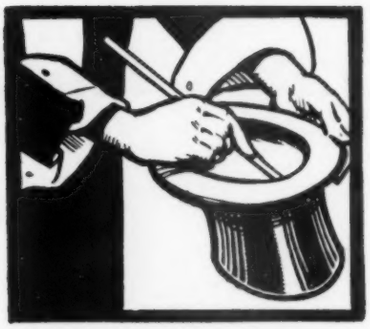
- Because Jaeger Truck Mixers produce a higher strength, more workable concrete, proven by impartial, recorded tests.
- Because so many engineers and contractors recognize this higher quality and prefer to buy from Jaeger operators.
- Because Jaeger 2-speed mixing and faster charging and discharging mean faster trips, more payloads, bigger earnings per unit.
- Because Man-Ten alloy steel, 3-point mounting, low center of gravity and correct load distribution make Jaeger maintenance amazingly low.
- Because Jaeger operators reorder as they grow — some as often as 10 to 18 times.

30,000,000 CUBIC YARDS OF JAEGER CONCRETE TELL THE STORY — Write today for Specification TM-37, describing Jaeger Truck Mixers and plant methods which have sold far more ready-mixed concrete than any other equipment on the market.
THE JAEGER MACHINE COMPANY, 602 Dublin Avenue, Columbus, Ohio.

JAEGER TRUCK MIXERS

1, 1½, 2-2½, 3, 4, 5, 6 CUBIC YARD SIZES

Magic? NO — JUST COMMON SENSE!



● Users stress the simplicity and reliability of Speed-o-Matic hydraulic-pressure control. Where they had thought a complicated set-up necessary for its amazing results, they found merely a simple, practical, natural method of transferring the back-breaking effort of manipulating mechanical levers from the operator to the power of the machine itself. It increases digging speeds from 25% to 60%, which results in corresponding yardage increases.

Link-Belt Company, 300 W. Pershing Road, Chicago. Distributors and Offices in Principal Cities.

7272-C

Link-Belt K-480 Electric Speed-o-Matic Dragline with 70-ft. boom and 2¼ cu. yd. dragline, at the Blue Diamond Corp's new gravel plant at El Monte, Calif. One of three Speed-o-Matics bought on performance in direct comparison with numerous other makes of machines this company has in service.

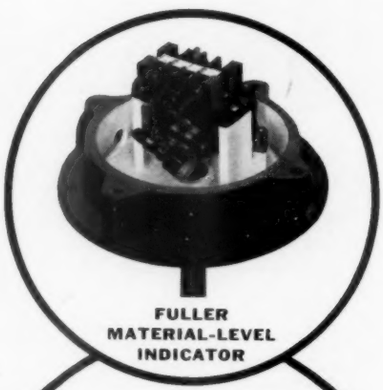
LINK-BELT
Speed-o-Matic SHOVEL
DRAGLINE - CRANE

PIT AND QUARRY, March, 1938. Vol. 30, No. 10. Published monthly by the Complete Service Publishing Company, 538 South Clark Street, Chicago, Ill. Subscription price $1 for 1 year in the U. S. and possessions, Canada and Central South America; elsewhere $1 additional for each year. Single copies 20 cents. Entered as second-class matter February 28, 1932, at the Post-Office at Chicago, Ill., under the Act of March 3, 1897. Additional entry at Milwaukee, Wis.

Component equipment in your system must be right

THE old saying, "A chain is only as strong as its weakest link", holds true in your plant, both as to equipment and method of operation. Your plant can only be as efficient as the component equipment that goes into it. Somewhere along the line there may be a weak link that is slowing up production, a link that might easily be strengthened.

The experience gained by Fuller engineers over many years has resulted in the production of much component equipment for handling pulverized or granular materials, a few of which are illustrated and described on this page.

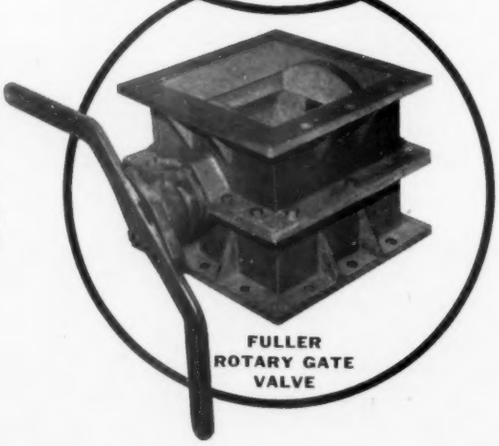


FULLER MATERIAL-LEVEL INDICATOR

FULLER MATERIAL-LEVEL INDICATOR: A device to control conveyor motors, valve circuits, etc., or give audible or visible warnings when the material reaches or falls below a predetermined level in a bin. This indicator is positive in operation. It will not make a false indication, neither (1) in the event of a momentary surge of material in the bin, nor (2) indicate a low level when an aerated pulverized material settles. One or more circuits such as signal, motor control, valve control, or the like, can be opened or closed by the same indicator. The necessity for relays has been eliminated, as the switches are positively held in the desired position when the material is above or below the predetermined level. The switches may be actuated instantly when the material level reaches the indicator or may, by adjustment, be delayed for any interval up to 10 seconds. As the interval between the time when rotation of the paddle is arrested and the switches are actuated is adjustable to provide a lag, the switch mechanism is not affected by a momentary surge of material against the paddle.

FULLER ROTARY FEEDER

FULLER ROTARY FEEDER: A feeder of consistent, volumetric accuracy for raw materials, pulverized coal, cement, lime, and many other applications in chemical plants. Close control of feeding is essential in almost any plant having such materials to handle. This feeder is of rugged and simple construction and has no metal-to-metal contacts. Available in sizes to meet all normal plant requirements, each size having a wide capacity range without loss of accuracy.



FULLER ROTARY GATE VALVE

FULLER ROTARY GATE VALVE: This valve is rapidly becoming standard equipment for material flow control from bins, silos, etc. Unrestricted opening permits free flow of materials which have a tendency to arch. Free movement of rotor to open and closed positions assured by careful machining and alignment of trunnion shafts in dust-tight bearings. No leakage in closed position, and rotor is built to avoid sticking. Built in sizes to accommodate normal plant requirements.

FULLER COMPANY

CATASAUQUA, PENNSYLVANIA

Chicago: 1118 Marquette Bldg.
San Francisco: 320-321 Chancery Bldg.

G-8

FULLER-KINYON, FLUXO, AND AIRVEYOR CONVEYING SYSTEMS · · · ROTARY FEEDERS AND DISCHARGE GATES
ROTARY AIR COMPRESSORS AND VACUUM PUMPS · · · AUTOMATIC BATCH WEIGHERS · · · BIN SIGNALS

"WE'RE FROM MISSOURI"

—what one marble company learned about AIR HOSE

TRUE citizens of the "show me" state are the Carthage Marble Corporation of Carthage, Missouri, world's largest producer of gray marble. Seeking the best air hose for their jack hammers, they tried many different makes in their quarries to see for themselves.

Seven brands were tried out. Every hose met the same abuse from dragging and scraping over sharp rocks. Every hose was exposed to the full effect of oil in these line-lubricated hammers. Of these, six showed rapid wear in the cover and outside plies from cutting and abrasion, and excessive oil-deterioration—the best giving approximately 25 months' service with many shutdowns.

14 months longer wear

The seventh was a 1" Goodyear Emerald Cord Hose recommended by the G.T.M.—Goodyear Technical Man. Under identical conditions it lasted 3¼ years—*more than 50% longer than any other make!* And in addition, production was increased and air cost reduced because Goodyear's air-tight, non-porous, oil-resistant construction prevents air seepage and flaking, insuring continuous full pressure at the toolheads.

That is why Goodyear Emerald Cord Air Hose is so widely used in heavy duty mine, quarry and construction work — *it lasts longer and saves money!* Why not talk over your hose requirements with the G.T.M.? To bring him to your office, write Goodyear, Akron, Ohio, or Los Angeles, California — or phone the nearest Goodyear Mechanical Rubber Goods Distributor.

THE GREATEST NAME IN RUBBER

GOODYEAR

GTM-Specified

GOODYEAR EMERALD CORD HOSE for Carthage Marble Corporation, Carthage, Mo.

1 SPECIAL CONSTRUCTION HIDE TOUGH AND FIRM

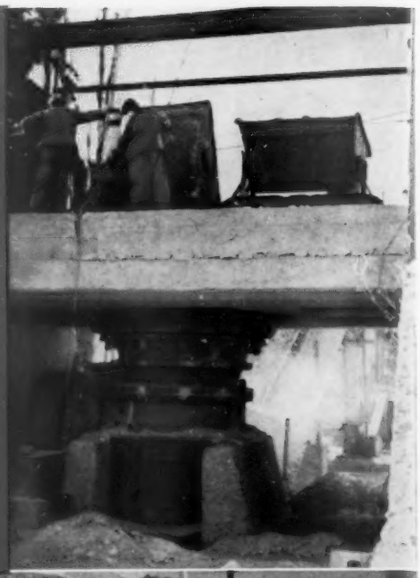
2 MULTIPLE DOUBLE BRAIDS OF CORD EXTRA RESISTANCE TO BURST AND VIBRATION

3 TUBE ESPECIALLY COMPOUNDED TO RESIST LUBRICATING OILS

BELTS
MOLDED GOODS
HOSE
PACKING
Made by the makers of Goodyear Tires

Removing the over-burden in the Carthage marble quarries with Goodyear Emerald Cord Air Hose.

TELSMITH
QUARRY PLANTS
IN THE ARGENTINE

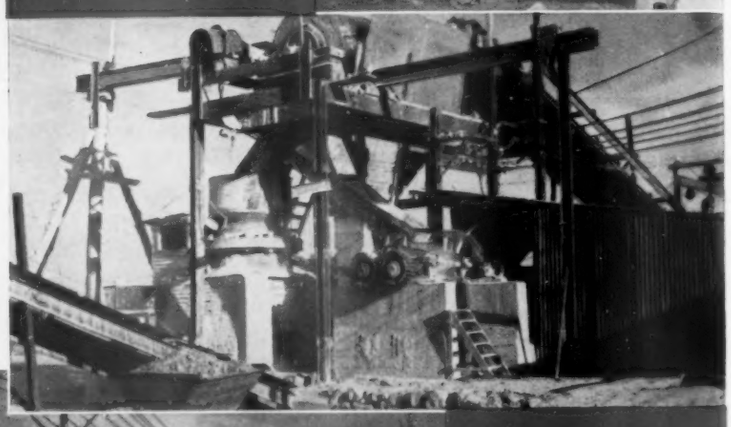


Telsmith Breaker has concrete around upper edge of its crown, and two walls 6 ft. apart form a "bridge" on which are two sets of tracks. Rock may be dumped from cars into both sides of crusher simultaneously.

● In the Argentine . . . as well as elsewhere throughout the world . . . Telsmith crushing equipment has convincingly demonstrated its ability to produce crushed aggregate for roads and concrete building construction *at the lowest cost per ton.*

The plant pictured here is that of J. B. Ripoli & Cia. located near Olivarria, a city about 200 miles south of Buenos Aires. On an average this plant crushes about 1000 tons of very tough granite rock, per 8-hr. day, to minus 2½-in. size.

It includes two Telsmith Crushers—a 20-in. Primary Breaker and a 46-in. Reduction Crusher—shipped in December, 1931. In spite of a steady diet of hard Argentine granite, their crushing performance has been outstanding. Maintenance has been low. During its six years of service, the Reduction Crusher has had no repairs other than manganese wearing parts. The super-strong steel frame and crown and the unbreakable shaft, which distinguish Telsmith gyratory crushers, are always an assurance of continuous output.



(*above*) Crushed aggregate from Telsmith Breaker goes to a rotary scalper which removes all minus 2½ in. aggregate, and chutes overcize to a 46-B Telsmith Reduction Crusher.

(*above*) General view of plant.

(*right*) In Argentine quarries, rock is hand loaded into side dump cars; trains are hauled up by hoist.

(*left*) Top view of Telsmith Breaker showing its massive crown arms set at right angles to car tracks; and the great spread of its receiving bowl.

Telsmith quarry and gravel pit equipment, from crushers to bin gates, and Telsmith engineering service are described in Bulletin Q-15. *Write for it.* Q-C1-38

50 Church Street, New York City
211 W. Wacker Drive, Chicago, Ill.
713 Commercial Trust Bldg., Philadelphia, Pa.
81 Binney St., Cambridge, Mass.
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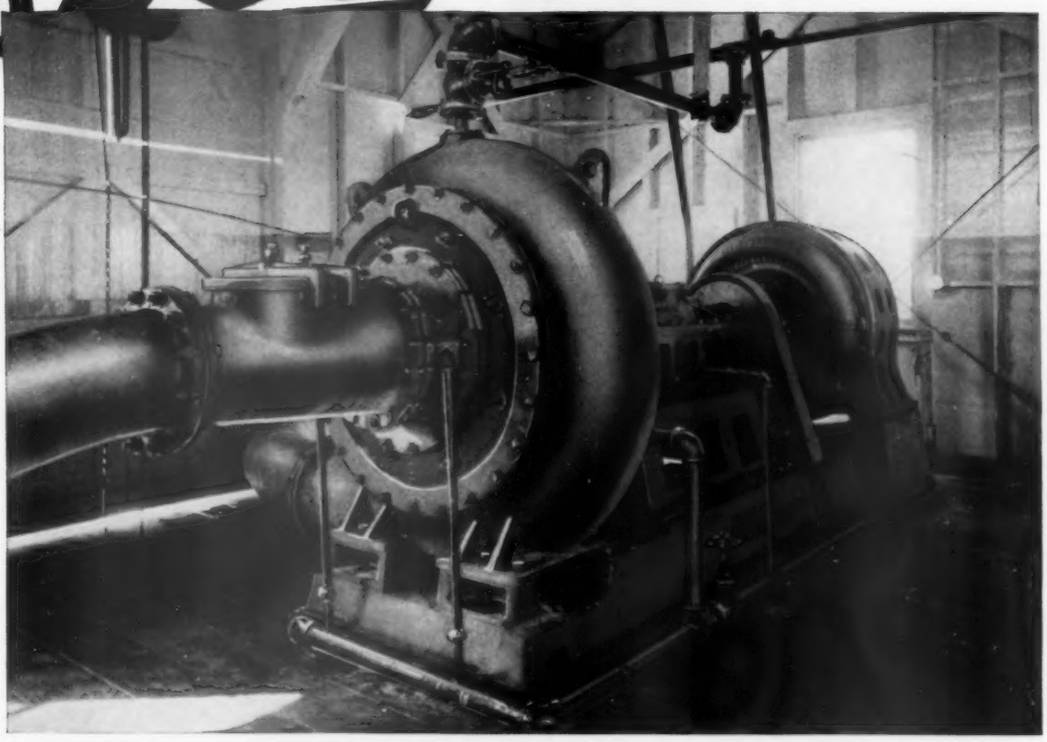
SMITH ENGINEERING WORKS
504 E. CAPITOL DRIVE, MILWAUKEE, WIS.

AMSCO PUMPS



for PROFITABLE AGGREGATE PRODUCTION

5 POINTS OF SUPERIORITY!

All parts exposed to impact and abrasion are made of tough, wear resistant AMSCO Manganese Steel.

"COUNTERFLOW" Design reduces impeller and shell wear.

Threading of impeller bore and shaft provides permanent security of impeller on shaft.

Sturdily designed bearings provide maximum service over long periods.

AMSCO Design is proved by the efficient and economical performance of a thousand installations over twenty years.

All steels contain some manganese, but genuine manganese steel contains 10 to 14% manganese and is austenitic in metal structure, which enables it to resist impact and abrasion better than any other steel.

The quickest, most dependable and least expensive method of moving sand and gravel from deposit to washing plant is with an AMSCO "COUNTERFLOW" Pump.

Operating and maintenance costs are at a minimum where AMSCO "COUNTERFLOW" Pumps are at work because AMSCO "COUNTERFLOW" design, by means of which clear water is introduced between the impeller shrouds and the side plate liners, minimizes internal wear. Impeller bore may be threaded and screwed onto shaft to provide greater secruity than keys and lock nuts. Wide funnel-mouthed impeller reduces friction and the thrust action of liquids. Sturdy bearings are exclusively employed. And, of course, the wearing parts of AMSCO "COUNTERFLOW" Pumps are made of AMSCO Manganese Steel, "the toughest steel known," which enables them to resist the most terrific impact and abrasion in service with a minimum of wear.

Hundreds of AMSCO Pumps are in use today making money for aggregate producers and other dredging and hydraulicking operators. Owners of AMSCO Pumps built previous to the introduction of "COUNTERFLOW" design can now have them converted at a moderate cost.

AMSCO Pumps are at their best when used with AMSCO Pipe Fittings, Flap Valves and Cutterheads.

Write for a copy of the bulletin completely describing all types and sizes of AMSCO Pumps.

AMERICAN MANGANESE STEEL DIVISION

of The American Brake Shoe & Foundry Company

396 E. 14th STREET, CHICAGO HEIGHTS, ILL.

Foundries at Chicago Heights, Ill.; New Castle, Del.; Denver, Colo.; Oakland, Calif.; Los Angeles, Calif.; St. Louis, Mo. • *Offices in Principal Cities*

MEMBER OF THE ALLOY CASTINGS RESEARCH INSTITUTE, INC.

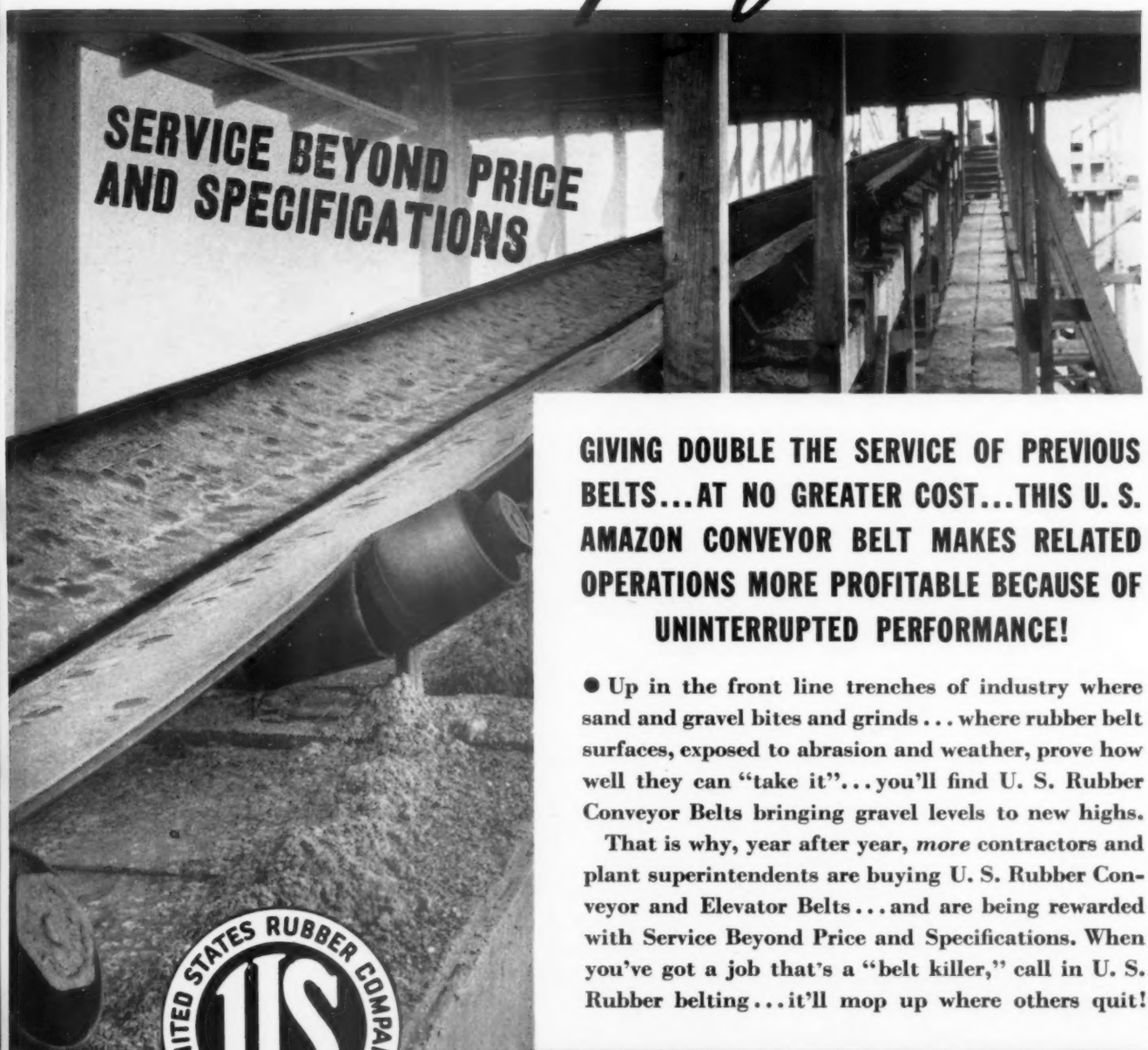
CONVEYING 600,000 TONS TEXAS GRAVEL—

LIFTING 3 MILLION TONS... SINCE 1924... ON 24-HOUR SHIFTS... WITH NEVER A LET-DOWN... THIS U. S. RUBBER MATCHLESS ELEVATOR BELT IS ANOTHER EXAMPLE OF SERVICE BEYOND PRICE AND SPECIFICATIONS. USE IT ON YOUR JOB.

Tune in on Ben Bernie—Columbia Broadcasting System Wednesday Evenings on the U. S. Rubber Royal Master Tire Program with an all star cast.

OF THE MOST ABRASIVE

With little sign of Wear!



GIVING DOUBLE THE SERVICE OF PREVIOUS BELTS...AT NO GREATER COST...THIS U. S. AMAZON CONVEYOR BELT MAKES RELATED OPERATIONS MORE PROFITABLE BECAUSE OF UNINTERRUPTED PERFORMANCE!

● Up in the front line trenches of industry where sand and gravel bites and grinds . . . where rubber belt surfaces, exposed to abrasion and weather, prove how well they can "take it"... you'll find U. S. Rubber Conveyor Belts bringing gravel levels to new highs.

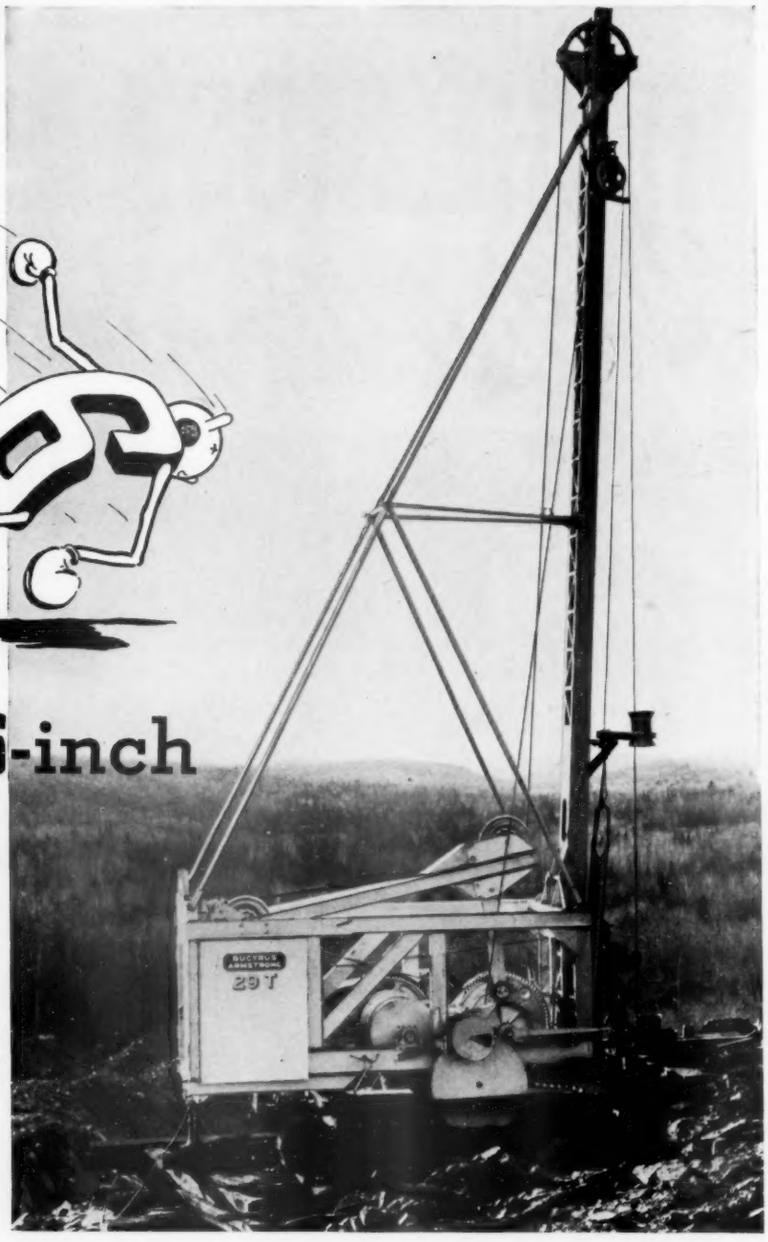
That is why, year after year, *more* contractors and plant superintendents are buying U. S. Rubber Conveyor and Elevator Belts... and are being rewarded with Service Beyond Price and Specifications. When you've got a job that's a "belt killer," call in U. S. Rubber belting... it'll mop up where others quit!

UNITED STATES RUBBER COMPANY · US · TRADE MARK ·

United States Rubber Company

United States Rubber Products, Inc., New York, N. Y.

9-inch VS 6-inch Blast Holes



WHEN two Bucyrus-Armstrong 29-T blast-hole drills for 9-inch diameter holes replaced 6-inch drills on an open pit mine in Michigan a little more than a year ago, here is what happened—During the year, the average OPERATING cost for drilling the 9-inch hole was $1.69 per foot. This compares with a previous cost of $1.95 per foot of 6-inch hole. Not only this—but with the 9-inch hole, the average burden was 44.5 tons per foot of hole. With the 6-inch hole, this burden had been only 24.4 tons per foot of hole. The introduction of the Bucyrus-Armstrong 9-inch drills meant, in this case, a reduction in drilling costs from 8c per ton to less than 4c—an actual saving of 52½% in favor of 9-inch hole. Can YOU afford to ignore the savings possible with these modern Bucyrus-Armstrong drills? Send for illustrated bulletins.

BUCYRUS-ERIE

BUCYRUS ARMSTRONG

DRILLING, EXCAVATING, AND MATERIAL HANDLING EQUIPMENT . . . . SOUTH MILWAUKEE, WISCONSIN, U.S.A.

VERSATILE
AS A "ONE-MAN" BAND

• BALANCE — unitized equipment is the thing that cuts the cost of moving earth, ore, rock or gravel. Notice the "Caterpillar"-powered outfit pictured here . . . equipped to make itself useful "going and coming"; to keep busy on various chores or jobs.

The views are by courtesy of the Ottawa (Illinois) Silica Co. The jobs: (a) Removing overburden from silica deposits; and, at other times, (b) building dike for encircling a large basin for settling water for re-use by the silica washer.

No time or power is needlessly wasted. Pulling a LeTourneau carryall scraper, a "Caterpillar" Diesel D8 Tractor picks up the load and hauls it to dike or dump in one non-stop operation. Then it wheels about and with angledozer levels off on the way back (thereby eliminating the need of a separate unit). Exceptionally low operating costs are effected, not only through minimum "idle" time — per trip or per year — but through the use of cheap fuel economically utilized. And low maintenance is a further advantage "Caterpillar" Diesel power has shown this company under rough, hard-working conditions.

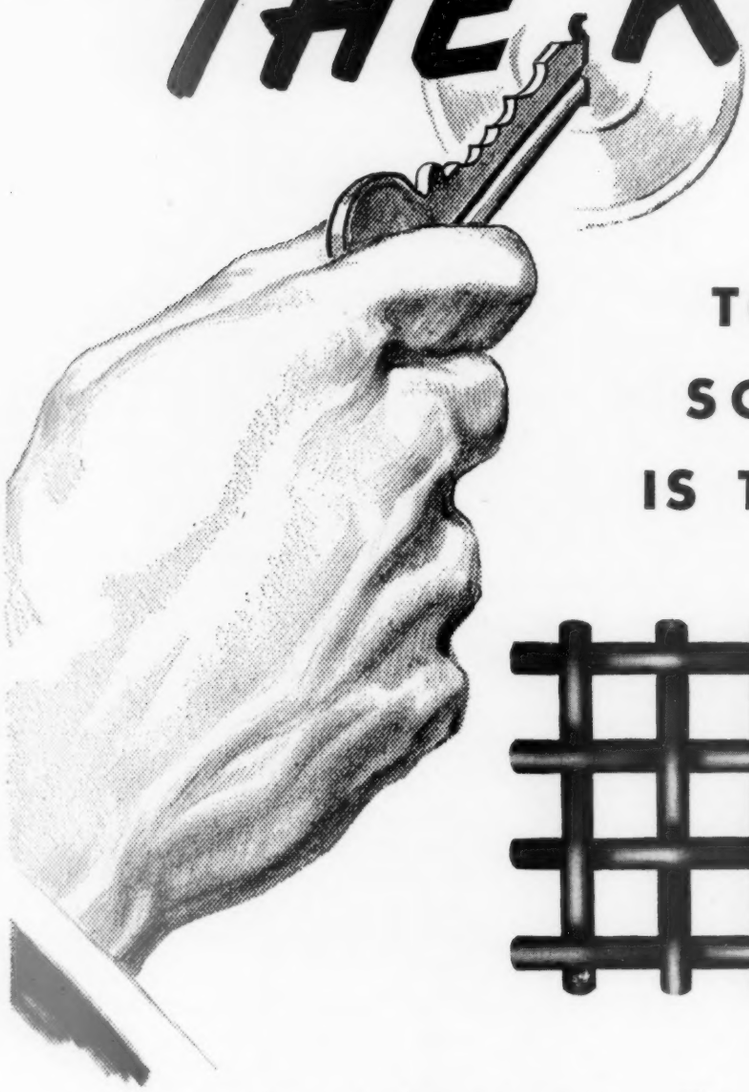
For moving raw, waste and finished material about rock or gravel plants, there's nothing like the motive power of "Caterpillar" Diesel Tractors (five sizes); nothing like the stationary power of "Caterpillar" Diesel Engines (eight sizes) for crushers, screens, compressors; nothing like "Caterpillar" Road Machinery for grading and spreading. There's a "Caterpillar" dealer near you, and complete parts-and-service facilities throughout the world.

CATERPILLAR TRACTOR CO., PEORIA, ILL.

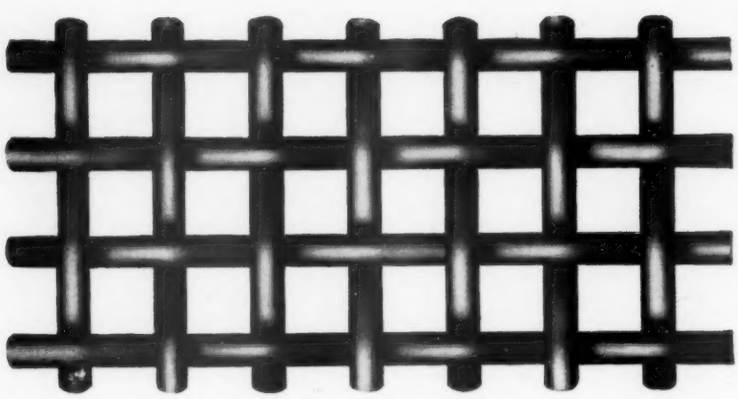
DIESEL ENGINES TRACK-TYPE TRACTORS
ROAD MACHINERY

CATERPILLAR
DIESEL POWER

THE KEY-



TO LONGER SCREEN LIFE IS TOUGH WIRE



There is no short cut to better wire screen . . . but there is a sound basis for selecting screen *wire*. A screen which gives long, efficient service under the constant grind of screening operations must have inherent toughness and stamina in the wire itself.

For over 90 years Roebling has specialized in making wire and wire products, famed for their exceptional strength and stamina.

This wire making knowledge, plus almost 60 years of screen making experience . . . go into every Roebling Wire Screen. That is why we would like to cooperate in solving your own screening problem.

Roebling Wire Screening is available for every sizing, cleaning and grading service.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON, N. J. *Branches in Principal Cities*

ROEBLING *Wire Screen*

TRADE JERSEY MARK

90 YEARS OF WIRE MAKING SPELLS THE DIFFERENCE

PRINT IN

Here's NEWS with a big CASH VALUE

The Brooks LOAD LUGGER

Broadside of truck and Brooks LOAD-LUGGER. Note carefully it's simple, compact construction . . . absence of complicated "gadgets", cables, sheaves and hydraulic hose.

Because of its unusual design, made possible by years of precision mechanical design experience of our engineering staff . . . the Brooks LOAD-LUGGER requires no counter-weight on front of trucks. Therefore, the cost of carrying dead weight is completely eliminated. Note that all side-swing is completely eliminated by positive guides on buckets. The entire load is carried on the truck chassis, rather than by suspension.

ONE TRUCK WITH A "LITTER" OF BODIES.

The Brooks LOAD-LUGGER is an entirely new, revolutionary development in detachable truck buckets. It's low cost will amaze you. In it, our engineers have developed unexpected improvements. In design . . . in operation . . . in original cost . . . in maintenance cost — no other piece of equipment, offered for the same type of service, can touch it.

Only the Brooks LOAD-LUGGER follows the truck manufacturers recommendations for load distribution. 80% on the rear wheels—20% on the front wheels. The Brooks LOAD-LUGGER has the direct drive from power-take-off and hoist. This feature alone eliminates the frequent, costly replacement of high-pressure hydraulic hose, cables and sheaves. The Brooks LOAD-LUGGER, has buckets of one-piece construction, insuring long life, and withstands the brutal treatment demanded of such equipment.

Send your Rock Crushing and Pulverizing problems to Brooks Equipment and Mfg. Co., manufacturers of the internationally known DAY "Jaw Type" Rock Crushers, DAY "Swing Hammer" Crushers and DAY Pulverizers . . . a complete line for any desired capacity. DAY Crushers and Pulverizers have been manufactured continuously since 1914 and sold throughout the U. S. and many foreign countries. Complete information furnished on request.

BROOKS EQUIPMENT & MFG. CO.

Knoxville

A consolidation of Brooks, Payne, Osborne Equipment Co. and Day Pulverizer Co.

Tennessee U.S.A.

INT IN BINDING

KOEHRING Shovels

Heavy Duty construction in Koehring Shovels means Heavy Duty service under the most severe operating conditions. Be certain of steady production when the digging is tough. Koehring Shovels are built to give that extra service which assures high yardage. Low maintenance cost and continuous operation assure job completion with a profit. When you have a tough digging job, investigate the Koehring.

KOEHRING HEAVY DUTY

KOEHRING COMPANY

Pavers · Mixers · Shovels · Cranes · Draglines · Dumptors · Mud-Jacks

3026 WEST CONCORDIA AVENUE, MILWAUKEE, WISCONSIN

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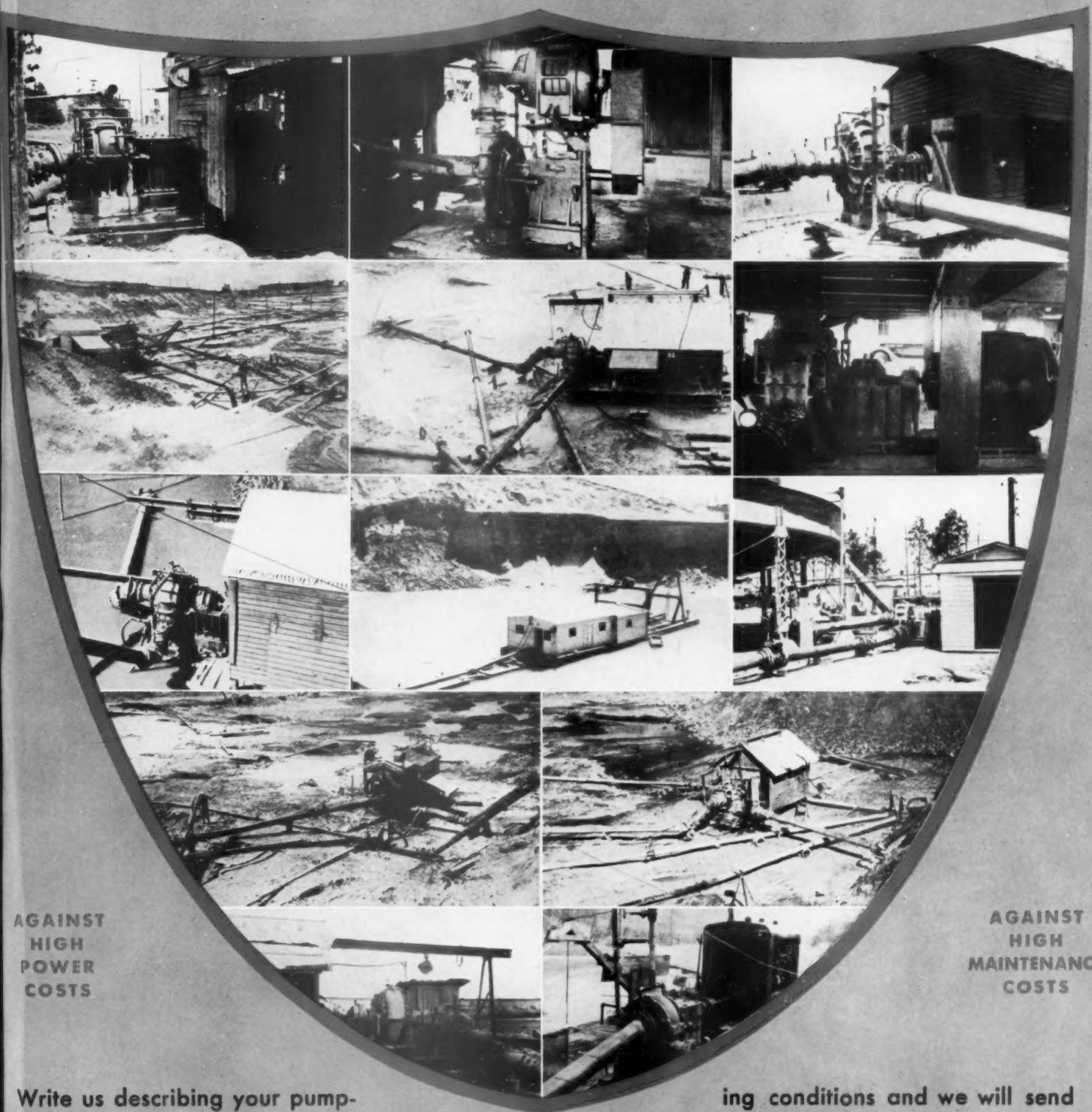


AGAINST HIGH POWER COSTS

AGAINST HIGH MAINTENANCE COSTS

Write us describing your pumping conditions and we will send you the names of concerns using Hydroseal Pumps under similar conditions. Then, you can write them direct asking anything you want to know about the economies and performance of this unusual pump. If you prefer, send for our new thirty-six-page catalog No. 937, or if desired, one of our representatives (located in all principal cities) will call.

HYDROSEAL MAXIMIX RUBBER PROTECTED DREDGE PUMPS

HYDROSEAL AND MAXIMIX DESIGNS ARE COVERED BY PATENTS AND APPLICATIONS IN THE MAJOR MINING CENTERS OF THE WORLD AND CAN BE PURCHASED ONLY THROUGH THESE COMPANIES

U. S. A.: THE ALLEN-SHERMAN-HOFF CO. 221 S. 15th St., Philadelphia, Pa.

CANADA: ALLEN-SHERMAN-HOFF, LTD. 602 Colonial Bldg., 11 King St., West, Toronto, Ont.

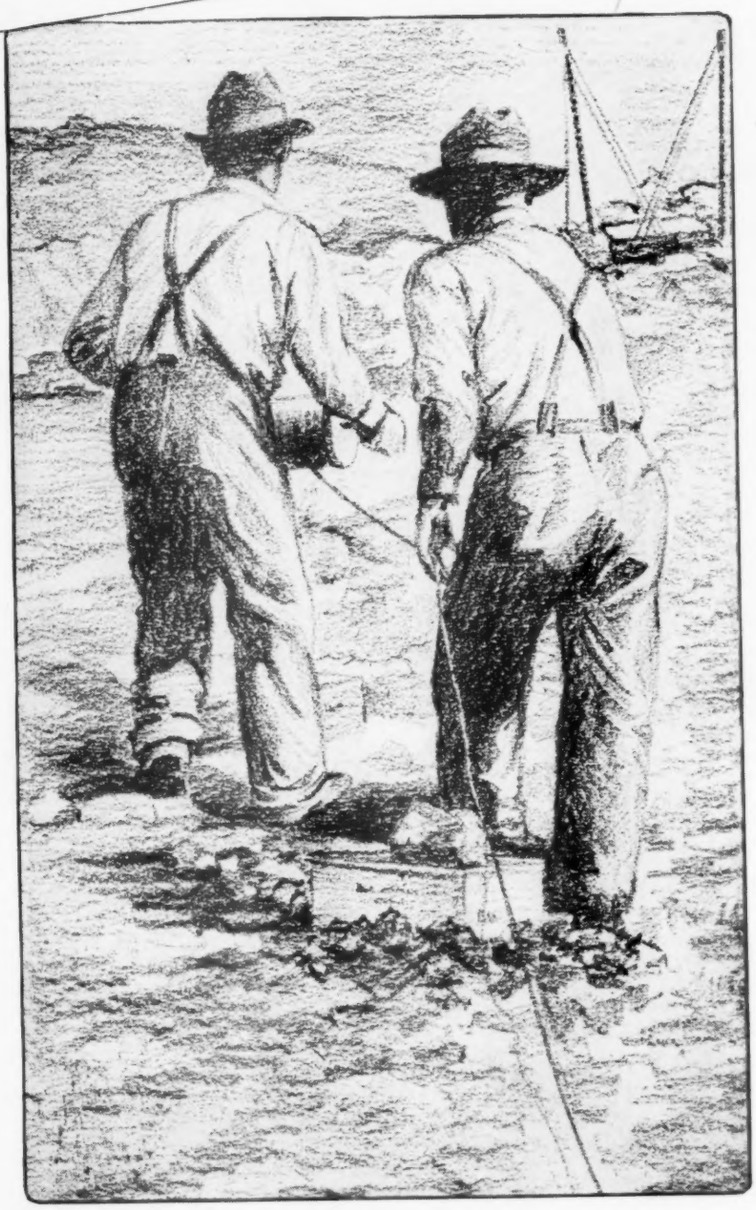
ENGLAND: THE ASH CO. (LONDON), LTD. 79/80 Petty France, Westminster, S.W. 1, London

PHILIPPINE ISLANDS: ATKINS, KROLL & CO., INC. Insular Life Bldg., Manila

Connect all Holes with Cordeau

EASY as laying a hose . . . and no more hazardous when Cordeau-Bickford, the insensitive detonating fuse, is used. With a bar slid through the core of the Cordeau spool, the coil is easily carried across the tops of the loaded bore holes, unreeling as it goes. Then the end of each branch line is connected firmly so that the detonating wave reaches each charge.

Thousands of holes in a giant blast can be loaded and connected with greater safety and economy when Cordeau-Bickford Detonating Fuse is used. Firing can be planned to give successive relief of burden, effecting maximum work from every charge, and better fragmentation of material.



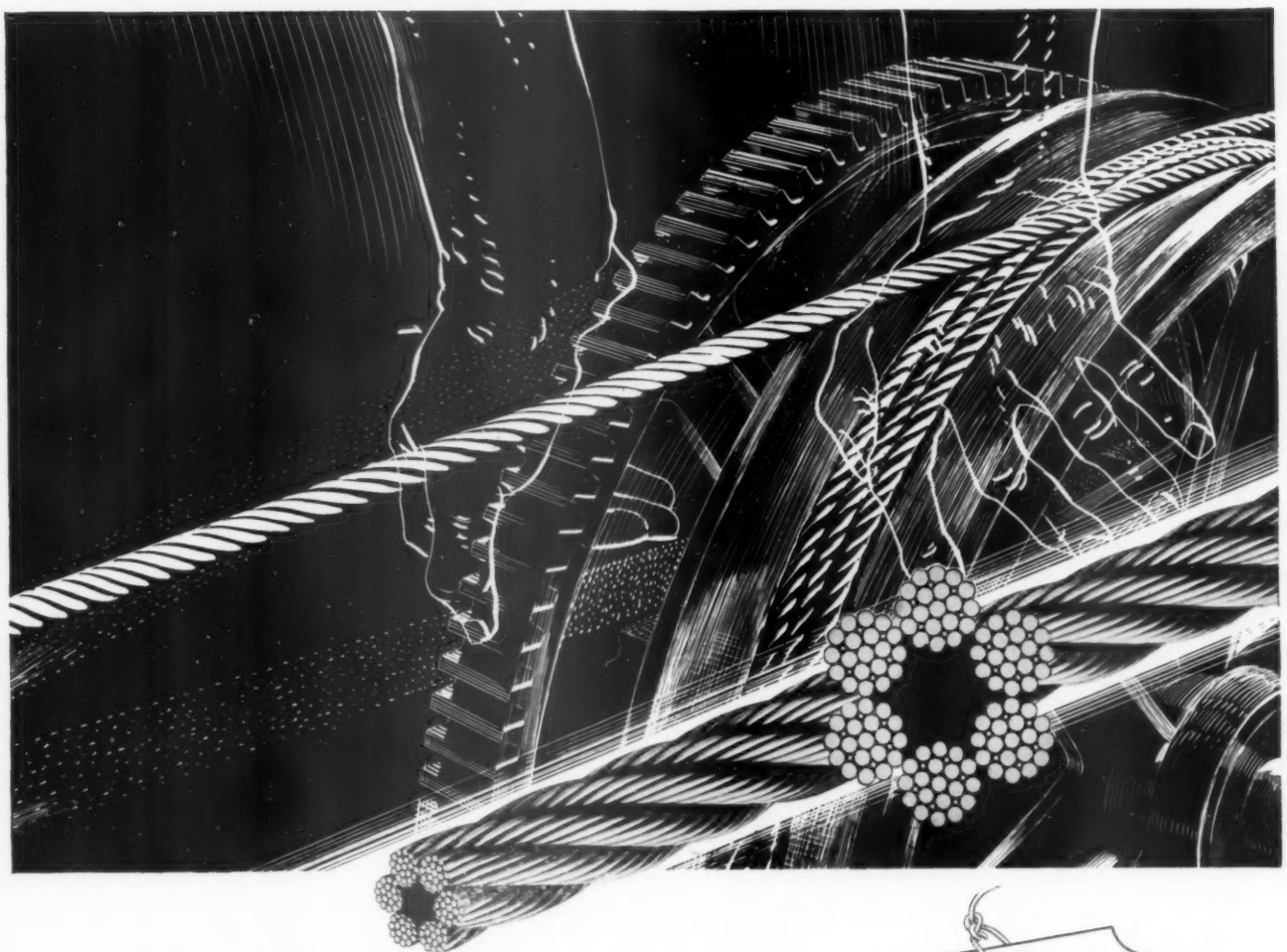
THE ENSIGN-BICKFORD COMPANY - SIMSBURY - CONN.

CB-71

CORDEAU·BICKFORD *Detonating Fuse*

EQUIPMENT pushed to the limit

CALLS FOR EXCEPTIONAL WIRE ROPE ENDURANCE!



Roebling "Blue Center" provides it!

Rising costs in industry make economy essential. Many concerns are cutting costs by getting the utmost work out of production and handling equipment.

If you, too, are subjecting your wire rope rigged equipment to the acid test of extra severe operating conditions—be certain that the wire rope you use will give you safe, economical service.

Roebling "Blue Center" Wire Rope has been developed to meet severest service conditions. For a wide variety of tough service applications, *it has proved conclusively that it assures lowest general average operating costs.*

JOHN A. ROEBLING'S SONS CO., TRENTON, N. J. *Branches in Principal Cities*

The Highest Development in Roebling Wire Rope
1 STRONGER
Wire of highest strength consistent with ductility and toughness
2 TOUGHER
Provides maximum resistance against wear, sudden shocks, vibration
3 SAFER
Unequalled for uniformity of quality
4 SAVING
Insures lowest general average operating cost

ROEBLING ✸ BLUE CENTER

WE HANDLE TOUGH JOBS

● You may be up against a tough screening job, too, like many other producers of gravel or aggregate, but your problem cannot be any tougher than supplying the enormous tonnage of aggregate needed for meeting the schedules of Coulee Dam. ● Four Style "B" Centrifugal Vibrating Screens have been handling the total minus 7-inch feed of this plant since May, 1937, much of the time 21 hours a day, 7 days a week. They have been doing a good sizing job continuously because they are built for that kind of work. The vibrating motion is positive . . . at the same intensity regardless of the load. ● Call in an Allis-Chalmers crushing plant engineer. He will show you why it is that the Style "B" screen will handle more tonnage and larger material, at lower cost, than any other type.

Your screening problem can be economically solved by one of the four types of Allis-Chalmers Vibrating Screens: Aero-Vibe for medium loads and materials; Low-Head for large tonnages and minimum head room; Style "B" Centrifugal for heavy loads and maximum range of material; and the Electro-Magnetic type for fine screening. Allis-Chalmers also builds a complete line of revolving screens.

886

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MILWAUKEE · WISCONSIN

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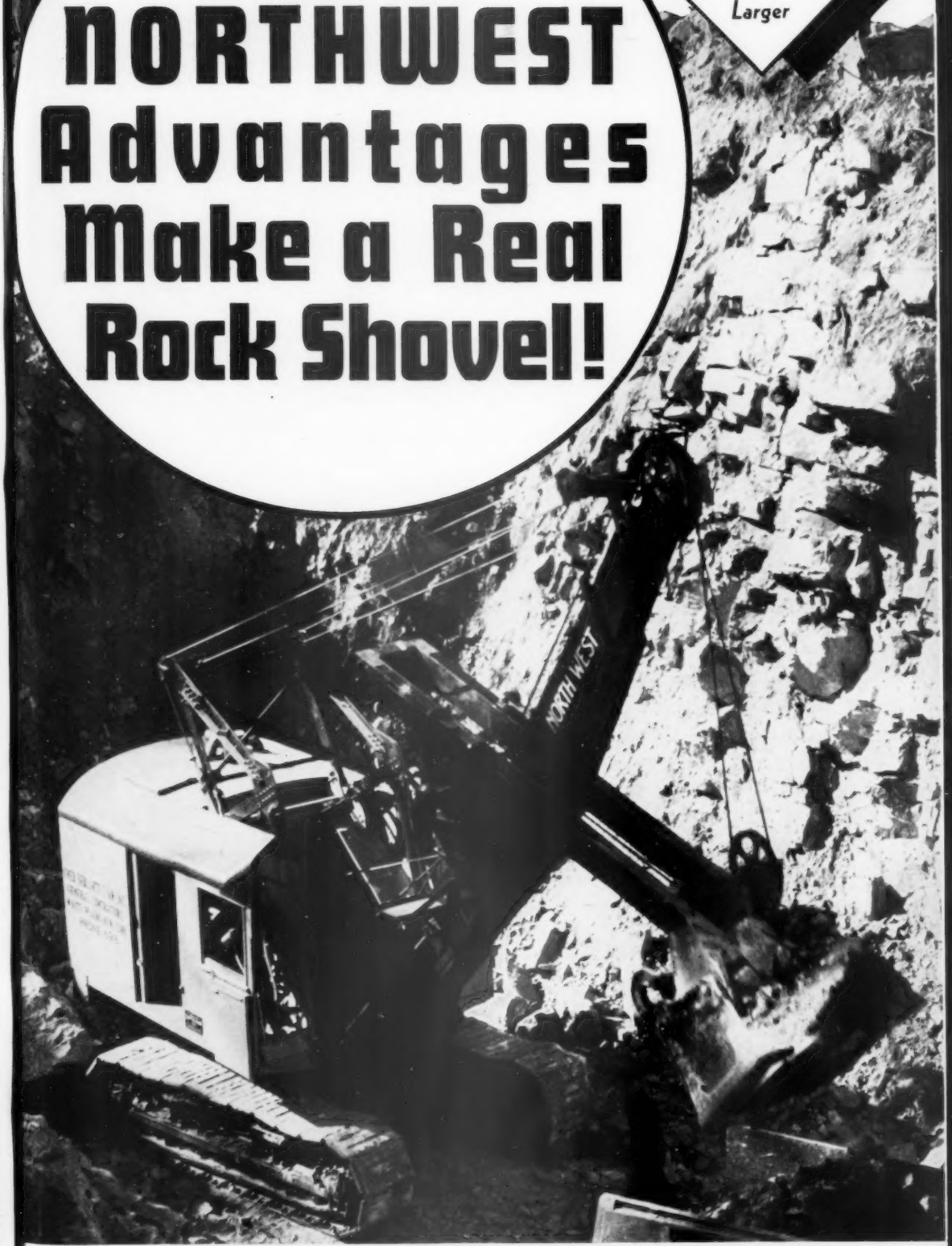
GASOLINE • ELECTRIC • DIESEL • OIL

Built in a range of 18 SIZES 3/8 yd. capacity and Larger

These NORTHWEST Advantages Make a Real Rock Shovel!



Northwest Independent Crowd
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- powerful

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Uniform Pressure Swing Clutches

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New "feather touch" Power Clutch Control

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Ball or roller bearings on all high speed shafts

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LOW COST Per Cubic Yard of Output

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NORTHWEST

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How many did you check? If more than five—*any five*—the chances are that "Flex-Set" Preformed Yellow Strand is your best buy.

Preforming shapes the strands during manufacture to the helical form they will maintain in the rope—with the amazing results listed above. The original "well-balanced" properties of Yellow Strand are *still there--plus* the advantages gained by preforming.

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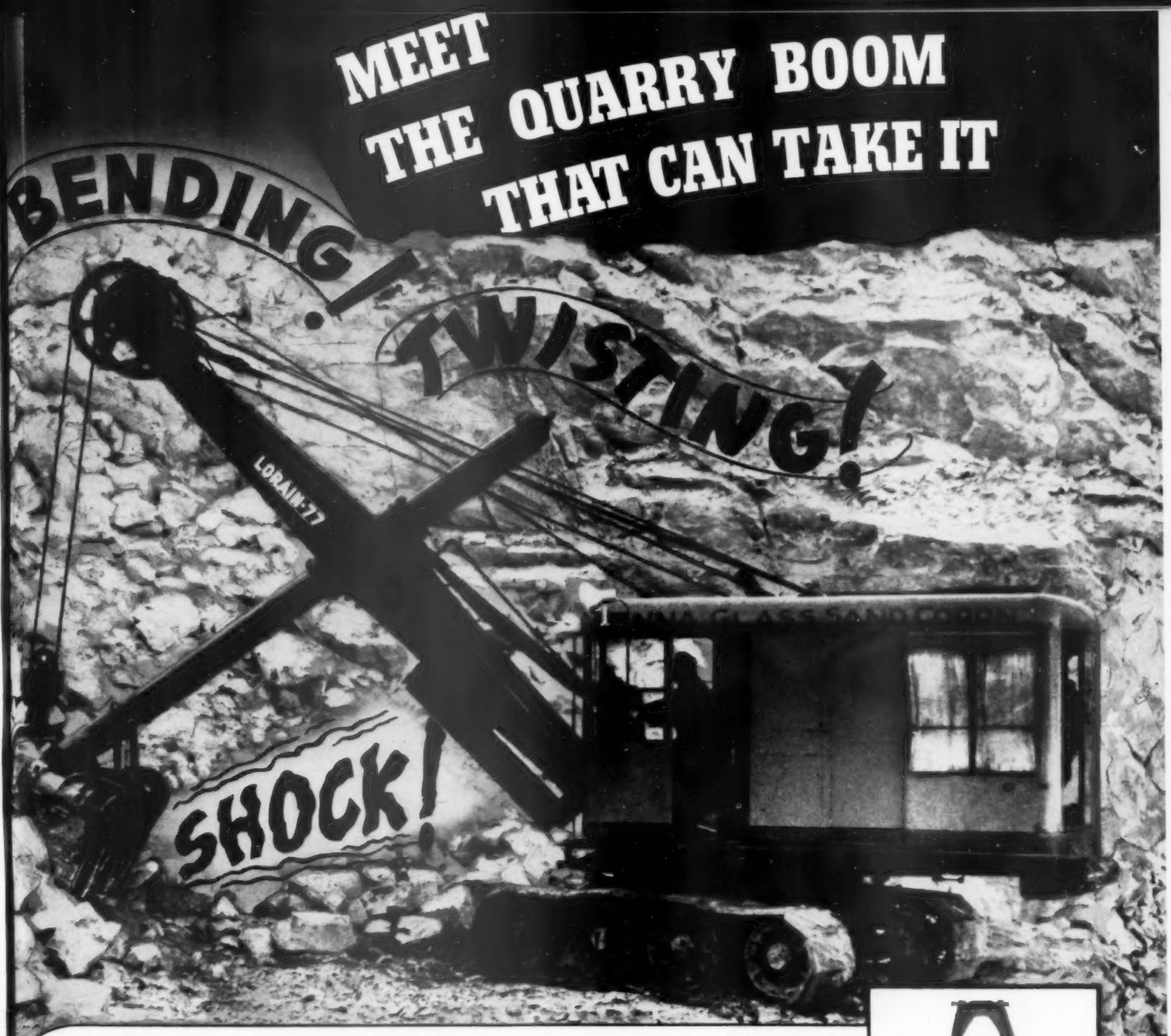
MEET THE QUARRY BOOM THAT CAN TAKE IT



Here's one boom that your shovel operators won't have to pamper. This new "front end" on the 1½-yd. Lorain-77 has what it takes to make routine work out of the most difficult rock-digging jobs. Examine the construction features shown in box at right of this page and you'll readily understand why the Pennsylvania Glass Sand Company of Lewistown, Pa., who use shovels for rock-digging service exclusively, have purchased 10 Lorains.

THE THEW SHOVEL COMPANY
LORAIN, OHIO

THEW CENTER DRIVE
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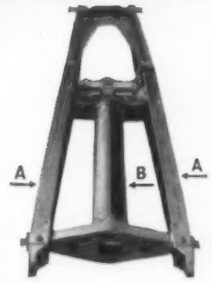
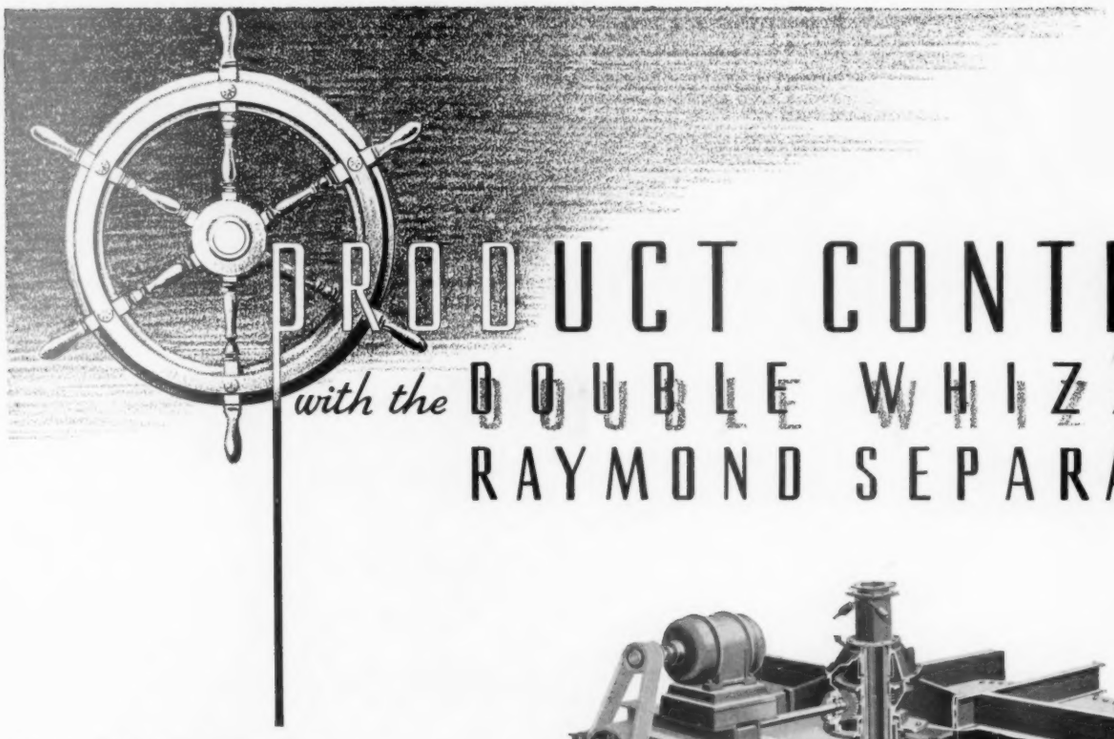


Here's How It's Done

The Lorain-77 shovel boom is virtually two booms in one... one, a structural member (A), absorbs all bending and compression stresses..the other, a torsional member (B), absorbs and resists all boom-twisting stresses. Each member is connected, independently, to the shipper shaft and boom hinges in such a manner that no torsional stresses pass through the structural members and no bending stresses can be transmitted to or through the torsion member.

LORAIN "77"



PRODUCT CONTROL
with the DOUBLE WHIZZER RAYMOND SEPARATOR

For High Early Strength Cement

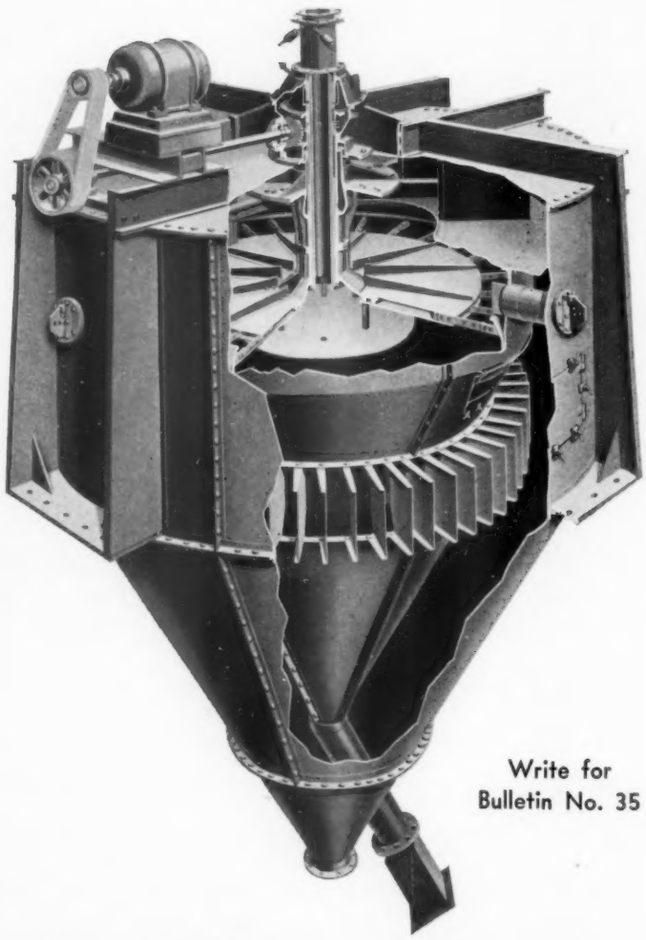
RAYMOND brings precision production to the cement industry by the development of the

DOUBLE WHIZZER PRINCIPLE

This exclusive feature of the Raymond Mechanical Air Separator insures proper distribution of particle size, and results in higher recovery of the finished product with a corresponding lower percentage of fines in the tailings.

By means of two distinct separating zones, each equipped with fineness controls adjustable from the outside, it is easy to produce a wide range of surface areas . . . from 1400 to 3000 or better . . . without stopping the separator or making any internal changes.

For accuracy and economy in meeting the rigid cement specifications of today, you need the positive operating advantages of this modern separator.



Write for Bulletin No. 35

Raymond Mechanical Air Separator
High Capacities — Low Circulating Loads

RAYMOND PULVERIZER DIVISION
COMBUSTION ENGINEERING COMPANY, INC.
1321 North Branch Street **CHICAGO**
Sales Offices in Principal Cities • • • In Canada: Combustion Engineering Corporation, Ltd., Montreal

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There is an Authorized Distributor at the other end of your telephone. It will pay you to get in touch with him now.

Manufacturers of TIMKEN Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; TIMKEN Alloy Steels and Carbon and Alloy Seamless Tubing; TIMKEN Rock Bits; and TIMKEN Fuel Injection Equipment.

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***TIMKEN**
ROCK BITS

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

17 FOR SAND AND GRAVEL PLANT

★ 26 FOR CRUSHED STONE COMPANY

that's how plants repeat on

CINCINNATI CONVEYOR BELTS

Every plant in the sand and gravel or crushed stone and rock industry has a problem of conveying tonnage at a low belt cost per ton . . . and that is why you find plants everywhere repeating on Cincinnati Conveyor and Elevator Belts.

It is not unusual to find plants buying 10 - 15 - 20 Cincinnati Conveyor Belts without a single change to a competitive belt . . . or buying "Cincinnati" consistently over a period of 12 - 15 - 25 years and longer. That display of confidence, gained by daily proof of stamina and profitable operation, shows how strongly they are sold on "Cincinnati."

Why don't you try Cincinnati Belts in your plant . . . find out about their long service . . . tonnage carrying power and low belt cost per ton conveyed?

THE CINCINNATI RUBBER MFG. CO. -- CINCINNATI, O.

New York Detroit Pittsburgh Boston Chicago Atlanta Buffalo Philadelphia

*If Classifying Is Your Problem Here's the Answer!

★ HARDINGE COUNTER-CURRENT CLASSIFIER DATA—WET CLASSIFICATI

Size Class.	Material	Object	Fineness Mesh			CAPACITY				DILUTION			Sp.g. of ore	RPM Classifier	HP Req.	R
			Overflow	Oversize	Feed	O'rflow T/24hr. (dry)	O'rfl'w T/hr. (dry)	O'rsize T/hr. (dry)	Feed T/hr. (dry)	O'rfl'w % solids	O'rsize % solids	Feed % solids				
18"x4'	Limestone	Conditioner	3%+48 63% −200	74%+48 6.1%−200	66%+48 13% −200	5	.2	1.6	1.8	42	79	78	2.6	10	.2	Closed x8" H
18"x4'	Limestone	Closed circuit with 2'x8" H. Mill	tr.+200 94.7% −325	4.8%−325	.5%+48 28.4% −325	1.2	.05	.2	.25	11	72	55	2.6			Limit was finene
3'x8'	(Copper Gold Ore)	Classification B. Mill disch.	4%+100 66% −200	15%−200	45.4% −200	112										Heav grai
3'x8'	Building Sand	Washing silt from sand	65 Mesh	Under 1%−100	20M with											
3'x8'	Quartz Ore G	Closed circuit ...16" H.	tr.+65 64.4% −200	8.5%−200	19. −200											
4'x10'	Grai Salt		65M.	93.4%+65 6%−150	84.6%+ 2.42 −150											
4'x14'	Q C				2%+3											
4'x14'																
5'x12'																
5'x12'																
6'x																
6'x14'	Ore															
7'x16'	Lead Zinc Ore															
8'x20'	Lead Zin ore															
a. Th																
4-(																
3-1																
1-20																
1-24'x																
4-20'x																
2-25'x1																
5-25'x10																
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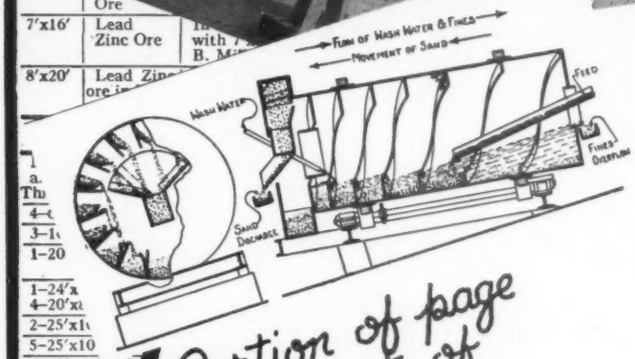
20' d Roun																
26'x Recta																
28'x8'																
30'																
Roun in 3																



THE HARDINGE COUNTER-CURRENT CLASSIFIER with these advantages: No dead corners to catch highgrade . . . Ability to handle any size of tramp oversize . . . Starts up fully loaded . . . Actually squeezes the slime and water out of the sand.

Write for Bulletin No. 41, and see what a Hardinge Counter-Current Classifier is doing elsewhere, that parallels your own needs.

Portion of page torn out of Bulletin 41 Send for it!

HARDINGE COMPANY INCORPORATED

YORK, PENNSYLVANIA, *Main Office and Works*

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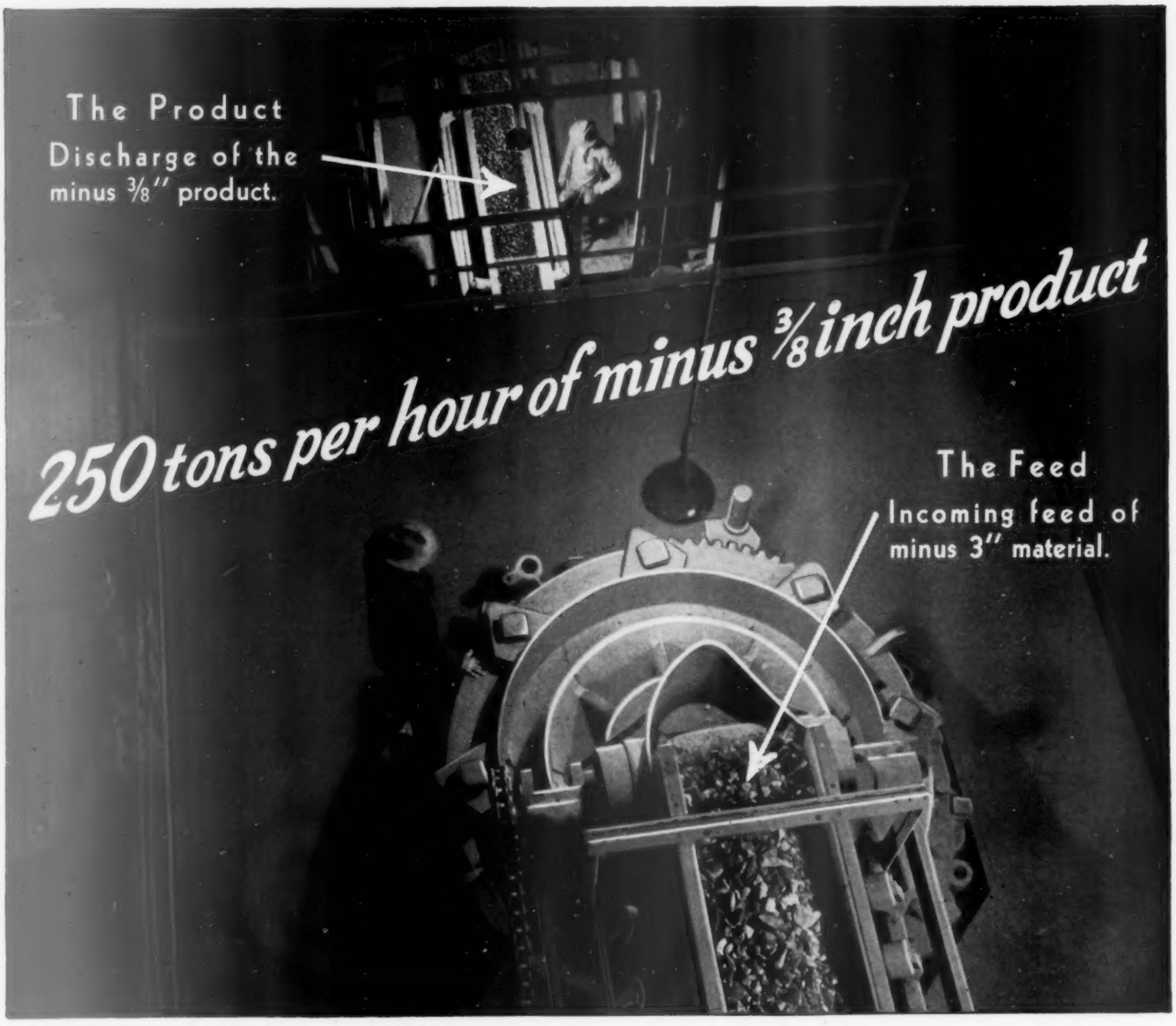
The Product
Discharge of the minus 3/8" product.
250 tons per hour of minus 3/8 inch product
The Feed
Incoming feed of minus 3" material.

Only with a SYMONS SHORT HEAD CONE CRUSHER *is such production possible*

Big Tonnage — Fine Product — Low Crushing Cost . . . . . these few words tell the story of the performance of this 7 foot Symons Short Head Cone Crusher. This is one more of the many instances where this type of crusher follows a Symons Standard Cone which had been previously installed. With the Short Head Cone, it is possible to produce fine materials in quantity and in such sizes for which there is a ready demand.

Are you confronted with the problem of quantity production of fine Product? If so, why not investigate the advantages of Symons Cones?

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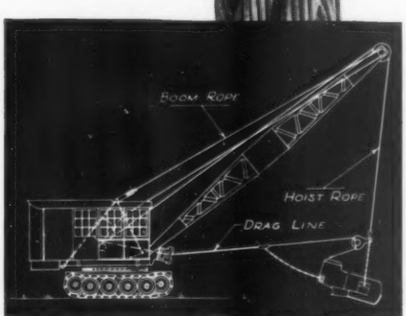
Diagram shows the ropes used on Drag Line Excavators. In writing for Recommendations give full classification data on each machine you are using



Where should a *Contractor* use **PRE-FORMED** rope ?

That pre-formed rope, though higher-priced, is more economical for many classes of service—is today a matter of actual record. Pre-formed ropes are free from internal stresses. This renders them especially effective where ropes are subjected to extraordinary bending stresses.

Contractors find our UNION-formed (pre-formed) Rope most economical for all hoist lines on all types of equipment. Other services in which UNION-formed Ropes have proved their superiority, are as drag ropes for drag-line excavators, all ropes for wagon scrapers, ropes for concrete chutes and towers. UNION-formed Ropes will also be found best for many other services. The complete recommendations of our engineering staff are promptly available. Write fully.

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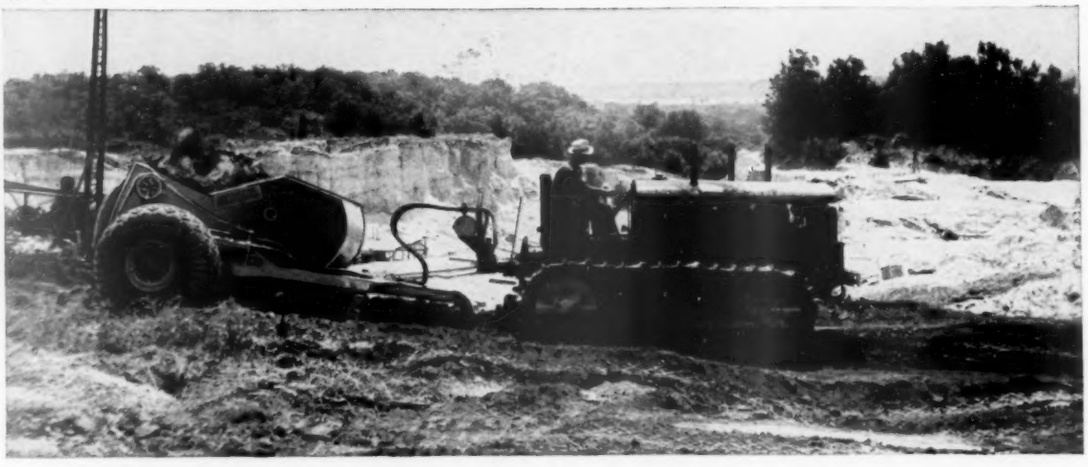
The "ULTIMATE LOW COST WIRE ROPE"

They Call Their Continental

"Sandy Mac Gravel"!

Because It Gets Out Sand and Gravel with Economy that Would Tickle any Scotchman!



Like many pit operators, this operator finds Continentals ideal for stripping overburden, building ramps, and digging, loading and hauling sand and gravel. A fast, one-man outfit handles the whole job.

Continentals back-dump like a truck, which makes it easier for them to load trucks or cars, or waste into low spots; and they do the job single-handed without the need for shovels, draglines or other digging, loading or hauling equipment.

They're economical all the way through — low in first cost, low in operating cost, low in maintenance cost, bigger loads, faster digging, speedier dumping.

Continental Wagon Scrapers are made in 4, 5, 7 and 10 yd. sizes with low pressure tired wheels or crawler mounted for use where the going is tough.

Ask your Allis-Chalmers dealer for details on what Continentals can do for you in your sand and gravel pit!

CONTINENTAL ROLL & STEEL FOUNDRY CO.
Tractor Equipment Division
14400 Railroad Avenue
East Chicago, Indiana

SUPERIOR ROAD MAKING MACHINERY

CONTINENTAL WAGON SCRAPERS

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PIT AND QUARRY

Vol. 30 April, 1938 No. 10

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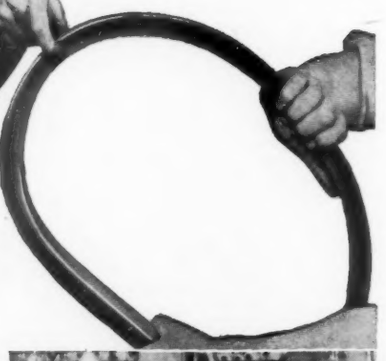
Shows Why You Want V-Belts With the Patented

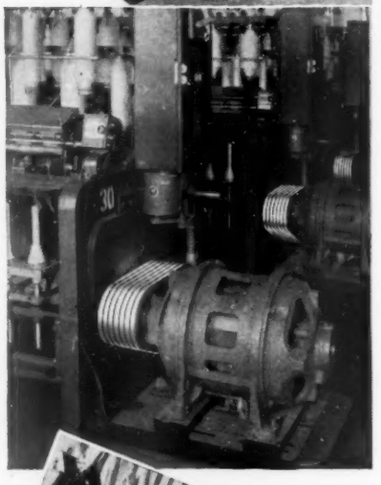
Concave Side

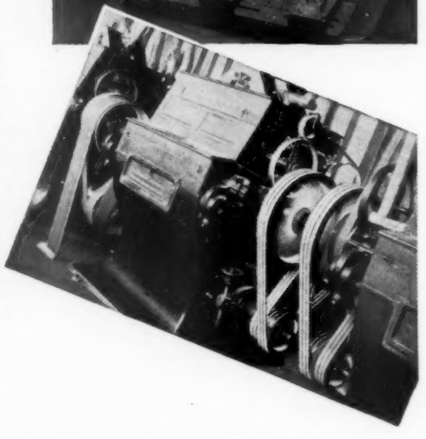
When *any* V-belt bends around its pulley, the top of the belt is under tension and grows *narrower*. The bottom, under compression, *widens*. As a result of these two changes, the sides of the belt *bulge out*. If the sides were *straight* to begin with, they are now forced into a shape that does not fit the sheave groove—as shown in figure 1, below.

Figure 2 shows how this shape change is corrected by the patented *concave side*. The top narrows, the bottom widens—but there is no side-bulge. This insures uniform side-wall wear which means *longer life*. Moreover, the full side-width grip on the pulley carries heavier loads without slippage; which saves belt wear and also saves power!

The Gates Vulco Rope is the only V-Belt built with the patented concave side.







Engineering Offices and Stocks in All Large Industrial Centers

THE GATES RUBBER COMPANY

Factory Branches

Terminal Building
Hoboken, N. J.

1524 So. Western Ave.
Chicago

741 Warehouse St.
Los Angeles

2213 Griffin Street, Dallas

999 South Broadway, Denver

GATES VULCO ROPE DRIVES

PIT AND QUARRY

CHICAGO APRIL, 1938

Plants Suffer Damage in California Floods

WASHOUTS HAMPER SHIPMENTS

Floods which raged in southern California during the first week in March hampered operations at several plants but serious damage was not suffered by many, a survey has revealed. More than 11 in. of rain fell in five days with the heaviest fall on March 2.

The plant of the Southwestern Portland Cement Co. at Victorville suffered a loss of about $28,000, according to W. H. Cleary, engineer in charge of production. Tracks and the bridge connecting the quarry with the plant were washed out, the garage was flooded with 5 ft. of water, the dust-handling system was damaged and about 30 motors suffered water damage. Nearly the entire plant was covered with about 6 in. of silt after the water receded. Several workers' homes on the company's property were inundated but none were carried away. Twelve days after the flood, on March 14, the kilns were again fired and two days later the quarry resumed work following repairs to the bridge and relaying of track. Forty-eight hours after the flood crest, however, shipments began moving out of the plant by motor truck.

Considerable damage was done at the new plant of the San Gorgonio Rock Products Co., located in a canyon near Banning. Rebuilding began immediately by E. M. Kirk, owner and operator, to enable the carrying out of a contract to supply material to the Metropolitan Water District.

Three plants of the Consolidated Rock Products Co. suffered minor damage. Flood-control officials at Los Angeles credit an abandoned pit near the company's Roscoe plant with having saved portions of the San Fernando Valley from suffering more severe damage, the pit having acted as a catch basin, impounding much of the water which otherwise might have swirled its destructive way down the valley.

Between the kiln and shop buildings at the Southwestern plant the water reached the height indicated.

Consolidated's Sierra plant, located between El Monte and Monrovia, Cal., also suffered damage. Water in the

(Continued on page 32)

State of Texas Sues Six Cement Companies

PRICE FIXING IS CHARGED

Attorney General William McCraw of Texas on March 7 filed an anti-trust suit against six Texas cement manufacturers asking a possible maximum of $30,000,000 and forfeiture of charters. The suit charges price-fixing violations of state laws.

The cement companies were charged with entering into price-fixing agreements under a "code of ethics" about Jan. 3, 1929, when the Cement Institute, with headquarters in Chicago, was formed. Statutory penalties of $50 to $1,500 daily against each of the defendants for 3,348 days to March 7, 1938, were asked.

Named as defendants were the Lone Star Cement Corp., Dallas; the Southwestern Portland Cement Co., El Paso; Trinity Portland Cement Co., Dallas. Universal Atlas Cement Co., Dallas; Longhorn Portland Cement Co., San Antonio, and the San Antonio Portland Cement Co., San Antonio.

The Sierra plant of the Consolidated Rock Products Co. Shovel in foreground was being removed from pit when it was overtaken by flood waters. This photo was taken on March 6.

Proposed New Plant to Cost $1,110,000

SMIDTH PREPARES ESTIMATE

According to the prospectus of the Cotton States Portland Cement Co., Jackson, Miss., now in the development stage with plant site and quarry at Macon, Miss., the proposed plant will cost $1,110,000.

Cost estimate of the plant, chemical and burning tests of the deposit were made by F. L. Smidth & Co., New York, N. Y.

Officers of the company are: W. Horace Williams, New Orleans, La.; C. L. Till, Jackson, Miss., executive vice-president and treasurer; Evon A. Ford, Taylorsville, Miss., secretary.

G. L. & A. Had Improved 1937 Earnings Record

Gypsum, Lime & Alabastine, Ltd., Paris, Ont., reported a net profit of 14.2c per share for the year 1937, as compared with only 9 cents in 1936. Net profit of $62,365 is after reduction of extraordinary charges, $33,176 for flood damage at its lime quarries in Beachville, Ont., and $17,071 for a special meeting of the shareholders. During 1937, $287,000 worth of bonds were purchased out of proceeds of sale of assets. Sinking fund still in arrears $240,000.

Bentonites of Western Canada Investigated

The National Research Council, Ottawa, Ont., is investigating the bentonites from western Canadian deposits with a view to determining their suitability for oil refining and bleaching. Two of the most important deposits are situated in southern Manitoba and it is planned to have them commercially developed.

National Gypsum's Net Lower; Plants Improved

The National Gypsum Co. had net earnings of $687,427 for 1937 after provision for taxes, compared with $1,018,655 in the preceding year, according to M. H. Baker, president, in the annual report recently issued.

Driers and conveyors at each of the company's wallboard plants were lengthened to speed up production, while automatic-handling devices were developed to reduce costs, according to the report. The new calcining mill at Ft. Dodge, Ia., which was rebuilt following the destruction by fire of the existing plant, was scheduled to get into operation by April 1.

Alabama Lime Company to Produce "Dry Ice"

A new by-product plant which utilizes escape gases from lime kilns to make solid carbon dioxide, or "dry ice", has gone into production in Alabama. It is the $175,000 operation of Alabama Carbon Dioxide Ice, Inc., which operates adjacent to the plant of the Alabaster Lime Co., at Alabaster, Ala.

Florida Ready-Mixed Firm Is Reorganized

Operating as the Associated Dealers' Certified Concrete Co., the Orlando, Fla., ready-mixed-concrete concern sold and produced 4,136 cu. yd. of material in that city last year. The firm has just been reorganized as Transit Mix Concrete, Inc., with 1,000 shares of $20 par value stock. Incorporators were: C. F. Culver, C. M. Dunham and O. J. Bailey.

Cement Plant Resumes After 5-Month Strike

Operations are said to have been resumed at the Kenova, W. Va., plant of the Green Bag Cement Co. of West Virginia after having been closed because of labor difficulties since last September. Picket lines had been maintained about the plant property for five months.

Erects Cement-Storage Tanks at K St. Plant

Three cement-storage tanks costing approximately $15,000 are being installed at the K St. plant of the Smoot Sand & Gravel Co. at Washington, D. C.

Flood *(from page 31)*

pit reached a depth of over 30 ft., covering up two belt conveyors, one 500 ft. and the other 300 ft. long, a jaw crusher, and a shovel which was being removed from the pit.

The water is now receding at the rate of about one foot per day and the pit is expected to be entirely dry by about the first of July. Meanwhite the plant is being supplied with gravel from a higher level.

The San Juan Capistrano plant of Graham Bros. was isolated for a few days when roads and railroads were washed out, as was the plant of the Riverside Cement Co.

Plan to Cancel U.S. Road Aid Withdrawn

STATES TOLD TO GO AHEAD

Secretary of Agriculture Henry A. Wallace on March 18 sent a letter to the governors of all the states in which he informed them that President Roosevelt had withdrawn his proposal to cancel 1939 Federal-aid authorizations. The text of the letter follows:

"On Dec. 31, 1937, I wrote to you transmitting a copy of the apportionment of Federal-aid highway and grade-crossing funds authorized for the fiscal year 1939. In that letter I called your attention to the President's special message to Congress of Nov. 27, 1937, in which he recommended the cancellation of the 1939 authorizations. I also stated that the President would appreciate your coöperation, and that of your state highway department, in deferring the submission of projects under the 1939 apportionment until this matter had received the consideration of Congress.

"The President now feels that you should not be asked to further delay the submission of the road-building projects of your state, and accordingly I suggest that such projects be now submitted in the order of their priority.

"The coöperation manifested by you and your state highway department in this matter is greatly appreciated."

New York Sand, Gravel Plant to Start May 1

The new plant of the Corinth Sand & Gravel Co., located on the D. & H. Railroad south of Corinth, N. Y., is expected to get into production by May 1, according to F. L. Wellenreiter, secretary. Its capacity will be about 500 tons per day.

Type "L" sand, meeting New York highway department specifications, will be a specialty, although the company expects to produce the full variety of standard sizes of washed sand and gravel as well as industrial sands.

An item in the February issue of PIT AND QUARRY stated that the Gypsum, Lime & Alabastine Co. of Canada had been ordered by a Woodstock court to reimburse a farmer for property damage done by blasting and to erect a fence or screen to protect his property. According to F. Andrew of the company, there was no court judgment, the matter having been amicably settled out of court and the action withdrawn.

N.Y. Silicosis Code Hearings in Progress

DR. L. U. GARDNER TESTIFIES

Following hearings in the first appeals on the validity and reasonableness of the New York state silicosis code as applied to limestone quarries, the State Board of Standards and Appeals on Feb. 10 adjourned appeals in four cases, accepted present conditions in three and reserved decision in two. The hearings were conducted by Commissioners William J. Picard, Joseph P. Craugh and Raymond M. Fisher.

Reinspection of quarries by the Division of Inspection showed conditions not contrary to the code at the New York Trap Rock Corp. quarry at Haverstraw and at the General Crushed Stone Co. quarries at Jordanville and Auburn.

Hearing of appeals was adjourned on four quarries not in operation at the time, the date to be set when drilling is resumed. These quarries are operated by the General Crushed Stone Co. at Le Roy, by the Federal Crushed Stone Co. at Cheektowaga; by the Le Roy Lime & Crushed Stone Co. at Le Roy, and by the Cushing Stone Co., Inc., at South Amsterdam.

Decision was reserved on the appeals of the General Crushed Stone Co. at Akron Junction, and Glens Falls Portland Cement Co., at Glens Falls.

Testifying for the Glens Falls Co. was Dr. Le Roy U. Gardner, director of the Saranac Laboratory, who has made a 20-yr. study of the effect of dust inhalation on the lungs, and made X-ray tests of 21 workers employed by the company.

Dr. Gardner showed that 14 of the men had negative tests and seven showed non-significant lung shadows, indicating that there was no justification for silicosis diagnosis.

Sales Up; Expense and Taxes Cut Net Profit

Sales of Pacific Coast Aggregates, Inc., San Francisco, Cal., increased about 2 per cent. in 1937, totaling $1,805,876, against $1,776,744 in 1936, but higher costs and expenses prevented the company from making any earnings progress. Consolidated net profit for the year, however, was only $4,827 against net profit of $7,475 in 1936.

The company leased and started operating on Jan. 1, last, the properties of the Atlas Olympia Co. of California. The president of Atlas, A. K. Humphries, has been appointed a director of Pacific Coast Aggregates. Another new director is Edward H. Heller.

Charles M. Cadman, president of Pacific Coast Aggregates, said that $137,843 was spent on plant and property additions during 1937, the capital expenditure embracing improvements and additions to production units, distributing yards and equipment, and the purchase of real property required in connection with the company's principal distributing yard in Alameda.

Gravel Scow Grounded; Lost as Tide Recedes

A scow of the Boston (Mass.) Sand & Gravel Co., loaded with 7,000 tons of gravel, was wrecked on March 1 in Scituate harbor, where it was grounded. It split in two as the receding tide left one-half of it overhanging the channel. Capt. Alex Burns, Medford, Mass., narrowly escaped injury when the overhanging section dropped into the channel shortly after he had left it. The loss was estimated at $6,000.

Pennsylvanian to Head Sand-Lime-Brick Firm

Boice Bros., Inc., has taken over the sand-lime-brick plant of Boice Bros. at Pontiac, Mich., and is continuing to operate the business. In addition to bricks, sand-lime blocks are produced and the concern also serves the building industry of Pontiac with ready-mixed concrete.

New officers are: Charles A. Nicely, Watsontown, Pa., president; R. E. Cromis of Pontiac, secretary-treasurer.

Yosemite Cement's Net Shows Slight Decline

Net profit of Yosemite Portland Cement Corp. for 1937 totaled $134,391, against $128,794 in 1936. Sales in the year increased 6.6 per cent. to $828,118 from $776,641 in 1936, President A. E. Wishon told stockholders at the annual meeting held early in March at San Francisco.

$75,000 Fire Loss at Wool Plant in Indiana

Fire of undetermined origin recently swept a two-story building of the American Rock Wool Co. at Wabash, Ind., causing damage estimated at $75,000.

After a three-hour battle firemen brought the blaze under control. The building was erected less than a year ago.

Majority of Dealers See Better Business

UPWARD TREND PREDICTED

Increased business in the building-materials field during 1938 is expected by more than two-thirds of the 835 dealers who recently filled in questionnaires on the subject at thirteen housing clinics conducted by the Johns-Manville Co. in as many cities.

The clinics were attended by 2,582 building-material dealers, representing 1,837 different firms with a combined sales volume during 1937 of $135,-811,770. A total of 65 per cent. of the dealers expected the sales trend would be upward, 22 per cent. expected a slump, and the other 13 per cent. were non-committal.

Gross profits for the year were expected to be higher by 46 per cent. of those replying and 36 per cent. said they would be lower. As to net profits, 43 per cent. expected a rise and 39 per cent. anticipated a drop. On the basis of these expectations, it was pointed out, 58 per cent. of the firms indicated they were planning to increase advertising expenditures, which averaged 1.68 per cent. of sales in 1937, and 36 per cent. planned to increase their sales forces.

The survey also revealed that despite a slackening in building activity during the latter part of 1937, that year's sales averaged 20.5 per cent. more than in 1936, with the greatest increase, 36 per cent., being recorded for the Pittsburgh area.

Installs Paving Plant at Pekin Stone Quarry

A $10,000 aggregate-bituminizing plant has been placed in service at the quarry of the Pekin Stone Products Co. at Lockport, N. Y. The plant, owned by the Frontier Bituminous Materials Co. of Buffalo, will produce road material for highway projects in that vicinity this season.

Cincinnati, O., Awards Contracts for Sand

Contracts for sand totaling $28,-727 were recently awarded by City Manager C. O. Sherrill, of Cincinnati, O. Contracts went to the John Mueller Co. for 5,000 tons of lake sand, $11,945; Reading Sand & Gravel Co., 7,000 tons of asphalt sand, $7,350, and 1,950 tons of mason's sand, $2,-047; George L. Rack Inc., 6,600 tons of concrete sand $6,600; and the Ohio Gravel Co., 700 tons of sand for oiled streets $795.

Pennsylvania's Short Work Week Blasted

IS RULED UNCONSTITUTIONAL

The Dauphin County Court at Harrisburg, March 18, declared unconstitutional Pennsylvania's 44-hour week law for men, a measure enacted by the 1937 legislature and which was to have become effective Dec. 1. The action cleared the way for a state supreme court hearing on the law at the court's March session, which opened in Pittsburgh March 21.

Enforcement of the act, which had been termed by industry the most drastic piece of labor legislation to be enacted by any state and was described by proponents as a model law receiving consideration by legislators of other states, had been stayed by the lower court for the past month on a suit brought by a Perry County taxpayer who asked that the law be declared inoperative pending decision of legal questions.

Defeat Georgia Bill to Divert Gas-Tax Funds

A bill to divert a portion of the Georgia highway department's gasoline tax revenue to the county governments was defeated Feb. 10 in the lower house of the state legislature.

Complete Electrification of Oregon Gravel Plant

The sand-and-gravel plant of the Saxton & Looney Co., near Hillsboro, Ore., has been modernized recently, all equipment now being driven by individual electric motors. The company has signed a 10-year contract with the Portland General Electric Co. for power. Formerly the plant equipment was direct-driven by a Diesel engine.

Marquette Cement Plans Terminal at Vicksburg

Plans for a $250,000 terminal at Vicksburg, Miss., to serve Memphis, Tenn., and the lower Mississippi valley were announced recently by W. A. Wecker, president of the Marquette Cement Mfg. Co., at a meeting of the sales organization of the company held in Memphis. The company now has terminals at St. Louis and Memphis.

Feldspar Operators in Tariff-Protection Plea

North Carolina feldspar producers sent a delegation to Washington, D. C. on March 6 to seek a $6 per ton tariff on nepheline syenite, a mineral which is replacing feldspar in glass manufacture and other industries. The mineral, most of which is imported from Canada, now enters this country duty-free under the 1930 tariff act. Fifty per cent. of all feldspar produced in North America comes from western North Carolina.

The Black Hills Mining & Industrial Assn., Pringle, S. D., is establishing the third unit of its feldspar mill, and plans are reported to be under way for a fourth unit.

An expert shovel operator put this Bay City 20 shovel through its paces at the portable gravel plant operated by E. M. Rocho of Freeport, Ill., a short time ago, supplying 110 cu. yd. of sand and gravel per hour, day in and day out, for several weeks. The plant, as portables go, was a big one and the shovel's capacity to dig and load had to keep up with the producing capacity of the plant. It did this with little or no difficulty, according to Stanley E. Bates, head of the Tractor & Equipt. Co., Chicago.

Residential Building Decline Is Broken

BUT TOTAL CONTRACTS DROP

Contracts awarded for building and engineering work in the 37 eastern states during the month of February amounted to $119,038,000, according to F. W. Dodge Corp. This was a decline of 37 per cent. from February, 1937, and followed a drop in January of 20 per cent. from January of last year. Thus the decline of the later months of 1937 has carried through the opening months of the new year. This is the customary course of a "recession" like the present one, when many projects are deferred pending assurances of construction cost stabilization, change of general business sentiment, and, in the present case, legislative action.

Residential building undertaken in the 37 eastern states rose 10 per cent. during February, 1938 as compared with the preceding month. This gain represents the first break in the series of successive monthly declines for residential building which began last June. Residential contracts for February totaled $40,023,000 as compared with $36,207,000 for January. It is currently reported that preliminary applications for mortgage insurance, both on single dwelling and development projects for sale and for rent, have greatly increased since enactment of the new amendments to the National Housing Act; this may be an indication of increased residential building contracts some weeks hence.

Contracts for private building and engineering work amounted to $67,891,000 in February as compared with $74,630,000 for January. Public construction, on the contrary, dropped sharply from $120,842,000 for January to $51,147,000 for February.

By classes of construction, the February contract record amounted to $40,023,000 for residential building, $48,533,000 for non-residential building, $25,333,000 for public works and $5,149,000 for utilities.

Reinstatement of 200 Cowell Strikers Asked

Reinstatement of nearly 200 striking C.I.O. union members at the Cowell Portland Cement Co. plant at Cowell, Cal., has been recommended to officials of the National Labor Relations Board following hearings before a trial examiner. Following the walkout by the strikers, an A. F. of L. union was organized.

National Crushed Stone Assn.
National Lime Assn.
National Slag Assn.
Portland Cement Assn.

WITH THE TRADE ASSOCIATIONS

National Sand & Gravel Assn.
National Industrial Sand Assn.
National Ready Mixed Concrete Assn.

APRIL, 1938

New Equipment to Aid Gravel Research Work

Research work of the National Sand and Gravel Assn. research foundation is getting under way in its new quarters at the University of Maryland. Most of the present equipment is installed and in operation. A constant-temperature moist-curing room is under construction. A small room to serve as an office and to house the more delicate laboratory equipment is being built. A Los Angeles "rattler" is being constructed by the F. M. Welch Engineering Co. of Greenville, O., a subsidiary of the American Aggregates Corp., and it will be delivered shortly. Estimates are being received on the cost of construction of freezing-and-thawing apparatus to conform with recommendations which, it is expected, will be promulgated by the American Society for Testing Materials this year. A part-time arrangement has been made with Asst. Prof. George C. Ernst to exercise immediate supervision over the work at the University of Maryland.

Plans for a permanent and full-time laboratory staff are being held in abeyance until more complete returns have been received to the request of the Research Committee and the Board of Directors for the special investment in research funds. While investigation work is being carried out at the present time, the major program requires relatively long-time planning. Consequently, it can not be started until a substantial proportion of the funds budgeted by the Board of Directors is available.

PCA's Concrete-House Campaign Wins Results

Speaking at the recent concrete conventions in Chicago, W. D. M. Allan, director of promotion, Portland Cement Assn. declared:

"There were four times as many concrete houses built in 1937 as in 1927, at the peak of a building boom."

Much of the credit for this accomplishment falls to the association due to its intensive campaign of the last few years on concrete-house promotion. While its aim "to improve and extend the uses of concrete" is, of course, directed toward the increased use of Portland cement, benefit accrues in like measure to the producers of sand, gravel, crushed stone, concrete products, ready-mixed concrete and the equipment makers who supply these industries.

Machinery Makers Favor Consecutive Conventions

The Manufacturers Division of the National Sand & Gravel Assn., at its meeting during the recent convention at Cincinnati, approved the plan adopted in 1938 for consecutive conventions of the National Crushed Stone Assn. and the National Sand & Gravel Assn., the National Ready-Mixed Concrete Assn. meeting jointly. It also adopted a resolution pointing out that it would be of further assistance to its members if the National Sand & Gravel Assn. and the National Crushed Stone Assn. could work out a plan for the 1939 conventions whereby the opening day of the first convention would be Wednesday, with the second convention beginning on the following Monday. Such a plan as compared with the arrangements at Cincinnati for the 1938 conventions, when both conventions began on Monday, would curtail by three days the time necessary for exhibitors to spend at the convention city.

J. Fennell Berger, John A. Roebling's Sons Co., Trenton, N. J., was elected chairman of the Manufacturers' Division for 1938. Vice-chairmen are: F. E. Finch, Hardinge Co., York, Pa.; Delbert Kay, Nordberg Mfg. Co., Milwaukee, Wis.; M. S. Lambert, Robins Conveying Belt Co., Chicago, Ill.; A. A. Levison, Blaw-Knox Co., Pittsburgh, Pa.; Bruce G. Shotton, Hendrick Manufacturing Co., Pittsburgh, Pa.; L. W. Shugg, General Electric Co., Schenectady, N. Y.

Coming Events

May 2-6, 1938, Cincinnati, O. — American Mining Congress, Music Hall. Julian D. Conover, secretary, Munsey Bldg., Washington, D. C.

May 9-11, 1938, Cincinnati, O. — Annual convention, National Lime Assn., Netherland Plaza Hotel.

August 29-September 3, 1938, Grand Rapids, Mich. — Power Show and Mechanical Exposition, National Association of Power Engineers, Civic Auditorium.

October 10-14, 1938, Chicago, Ill. — National Safety Congress and Exposition, Stevens Hotel.

Felker Named Head of Sand-Lime Brick Assn.

Competitive conditions and changing trends in the sand-lime-brick industry were discussed informally at an interesting round-table, one of the features of the annual convention of the Sand-Lime Brick Assn., held Feb. 14-16 at Cleveland, O.

Officers for the new year were elected as follows: J. C. R. Felker, president; W. A. Smythe, vice-president; J. Morley Zander, secretary-treasurer.

Pittsburgh Assn. Cited for Fixed-Price Plan

The Building Material Dealers' Alliance of Pittsburgh, has been directed to "discontinue fixing uniform prices at which building materials may be sold, and to cease using concerted action, including boycott and threats of boycott, to induce manufacturers to refrain from selling building materials to dealers not recognized by respondents as entitled to buy direct from the manufacturers," in a cease-and-desist order recently issued by the Federal Trade Commission.

A fiberizing mill with a capacity of 600 tons of asbestos fiber a month has been built by the Emsco Asbestos Co. at Downey, Cal.

EDITORIAL

Economic Submergence and National Prosperity

WE IN America like to speak in glowing terms of what we are pleased to call our "high" standard of living. We visualize the "average" American wage earner as the owner of his house, the happy head of a large family, and the owner of shares of stock in large American industries. He is often pictured to us sitting in a huge "overstuffed" chair in his living room, listening to the entertainment coming from a "console" type of short-and long-wave radio. An imitation Oriental rug introduces a suggestion of Eastern atmosphere, while a few pieces of modernistic "gas-pipe' furniture remind him of the efficiences of machine production. His wife and older daughters glisten under freshly-acquired "permanents" and other evidences of their membership in the cult of personal adornment, the former reading the newspaper account of her club's last meeting, the latter pouring over the latest edition of her university "daily". Morning and evening newspapers and magazines of style, adventure, romance and travel lie about the room, which is suffused with the light of numerous electric lamps on the floor, on the tables and suspended from the ceiling. An electric fan "conditions" the otherwise fetid air, while the smoke from a pipe and two cigarettes gives a hazy blue tinge to the interior.

In the kitchen is a mechanical refrigerator, an electrical mixer for making drinks and cakes and squeezing oranges; in the basement is an oil-burner, an electric washing machine and mangle; in the bathroom is a floor scale to warn the family of impending obesity, an electric glow heater "for those chilly mornings", an array of colored toilet soaps, bottles and cans. In front of the house stands the family car, a "snappy" ready servant, waiting for the family's decision as to whether it shall be the movies, the Joneses, or a dash around town this evening. Everything indicates comfort, freedom from worry, health, happiness, and the serenity of civilized life in modern America.

As an adventure in the realm of make-believe, the picture has some interest, but as a portrayal of the life and surroundings of the "average" American family it is as unreal as Snow White and the Seven Dwarfs. The American standard of living is one of those subjects on which most of us prefer to be deluded rather than informed, so the net result is that the truth, when presented to us in incontrovertible statistical form is either brushed aside as incredible or accepted in calm indifference.

Although references in recent years to the "submerged third" have frequently been airily dismissed with the easy answer of "exaggeration", "political clap-trap", and the like, statistical evidence makes the phrase appear to be an understatement. Investigations conducted by the statistical bureau of the Department of Labor, by the Bureau of Home Economics of the United States Department of Agriculture, the Central Statistical Board, and the National Resources Committee have shown the great extent to which large portions of the population are deficient, not only in the luxuries, but in the necessities of life. The year 1929, in which most forms of industrial production and national prosperity reached their all-time "peaks", was a time when, according to the Brookings Institution, 74 per cent. of America's families did not have enough income to provide "an adequate diet at moderate cost". We should know more about the cause-and-effect relationship between such widespread economic weakness and the catastrophic economic collapse that followed. We should try to ascertain, too, to what extent the current business "recession" may be due to the continuance of such a deplorable situation.

THOSE of us who have not experienced the deprivations to which that 74 per cent. of American families have been and, undoubtedly, still are subjected will have difficulty in visualizing the degree to which these groups are economically submerged. Nevertheless, let us make an attempt to picture the severe limitations on health, comfort, and happiness which subsistence and below-subsistence incomes impose on three-fourths of the American nation. Suppose we start with the luxuries, proceed to those provisions for security which are considered prudent, and conclude with a consideration of necessities. We shall assume that yours is a typical American family, including the parents and two children, and that your income was lowered to less than $1,500 a year. Let us see what you would have to deprive yourself of to bring you down to an expenditure level that would enable you to support yourself and your family on that income.

You would first be forced to give up your automobile, because if you lived in a large city

you could not afford to own a motor car for transportation purposes. In Philadelphia, for example, only 23 per cent. of the white families have motor cars, in New York only 15 per cent., in Boston even fewer. You would be forced to use mass-transportation facilities at the lowest fare rates available to go to and from your work. This is listed as your first deprivation, because with you an automobile is probably a luxury, whereas with a wage earner it may be virtually a necessity, especially outside the big cities. Your reading would be limited to one newspaper a day, an occasional 5-cent or 10-cent magazine, and the books you could borrow from the public library. You would be compelled to reduce your expenditures for tobacco to about $15 a year, or approximately 4 cents a day, and you would have no money for alcoholic beverages. You would be able to attend motion-picture shows so infrequently that you would probably forget the names and faces of the principal "stars". Your church, your charities and your gifts would be cut to approximately a dollar a month.

You would have about $5 a year for the education of your two children, which, needless to say, would not enable you to send either one to college, and might not enable you to send more than one of them through high school. If you lived in the South, you would have to spend possibly as much as a dollar a year more for school books and supplies. You could not afford any preventive medical care, because you could not call your doctor oftener than once in five years for each member of your family. Your dentist could not be consulted more than half as often. If you became ill, you could not afford any hospitalization or home nursing care, yet as a wage earner you and your family would be ill oftener and for longer periods than your own experience would lead you to believe. You would not be able to spend for barbers more than a dollar a month for your whole family, and you could not find more than half as much money available for toilet soaps, tooth pastes and powders, and mouth washes. You would be forced to keep the entire family's total yearly expenditures for shaving, shampooing, manicuring, hairdressing, cosmetics, and cleaning and pressing inside $5.

YOU could not invest a single dollar a year in insurance of any kind, you could not have a bank account of any kind or size, the stock-market reports would hold no interest for you. Except for social security provided by your Federal and state governments, you would be utterly dependent on charity in disability or old age.

You woud live in rented quarters for which you would pay not more than $20 a month. Your facilities might include an inside flushing toilet, running hot and cold water, electric lights, and gas fuel in the kitchen if you lived in some of the cities, although Boston is the only city in the United States in which all the families investigated have inside flushing toilets. In Scranton, Pennsylvania, for example, 16 per cent. of the families do not have even ordinary ice-boxes. If you lived in the South, you would have even fewer facilities.

Your year's clothing expenditures would allow you $3 for hats and $8 for shoes for yourself and for your wife, $7 for your coats, $12 for your wife's, $22 for your suits and shirts, $17 for her suits and dresses.

If you lived in a city, each member of your family could eat about 19 pounds of food weekly, say 6 pounds of cereal products or potatoes, and only 3½ pounds of fruits and vegetables. The diet which three-fourths of the families in your supposed income class could afford would not assure health and efficiency.

Wholly aside from the psychic and physical readjustments which such a change of economic status would entail, consider, too, what such a change would mean to the business of the country, if it were multiplied millions of times, as it is in fact. Think what the reduced consuming power, the reduced buying power, of the huge economically-submerged portion of our population means to the prosperity of the country as a whole. Try to picture the expansion in production facilities that would be required, the new machinery and buildings that would be needed, to provide the commodities that could be bought by the 74 per cent. of America's people whose incomes are not sufficient to provide even "an adequate diet at moderate cost", if their incomes could be only moderately increased. Even the facilities and the output of 1929 were not adequate to provide them, according to the Brookings Institution's findings. An increase of some 70 to 80 per cent. in the production of all kinds of goods and services above the level of that year would be required to provide every American family with a liberal diet and the necessities and comforts which are usually found associated with such a diet, that institution has reported.

This is a prospect which affects the future of practically every industry in America. Its realization is being left to the efforts of government, although it is a matter of vital importance to business of all kinds. National prosperity can not be attained until the present extent of economic submergence is very greatly reduced. Will business men let this social sore run unchecked?

By W. E. TRAUFFER

Phosphate Recovery by Flotation at Two Florida Concentrators

THE International Agricultural Corp. for many years has been one of the largest producers of phosphate and related products. A washing plant, two concentrating plants and a drying plant are operated in Tennessee and a washing plant, two concentrating plants and a drying plant in Florida. In addition the corporation owns and operates 27 chemical and fertilizer plants spreading from Maine to Texas, in many of which this phosphate is used. The four concentrators are operated by a subsidiary, the Phosphate Recovery Corp., which controls the flotation process used in these plants and in plants operated by other companies in Florida and Tennessee. It is with the two concentrators in Florida that this article is chiefly concerned.

The electric drag-line with 165-ft. boom and 8-cu. yd. bucket, which removes overburden from pit supplying the No. 92 washer.

The concentrating plants operated by other companies which use the flotation process controlled by the Phosphate Recovery Corp., with their capacities, are:

Amalgamated Phosphate Co., Fort Meade, Fla., 200 tons per hr.

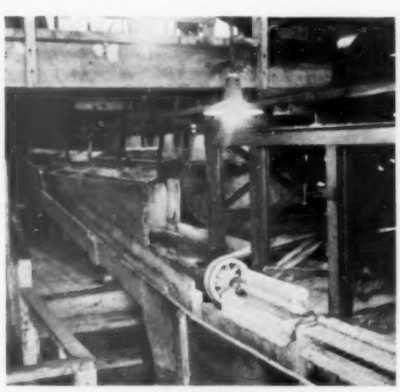
American Agricultural Chemical Co., Pierce, Fla., 50 tons per hr.

Charleston Mining Co., Mt. Pleasant, Tenn., 20 tons per hr.

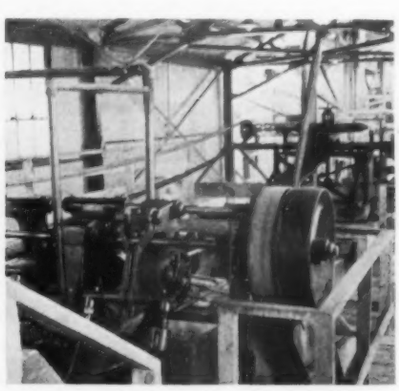
Swift & Co., Agricola, Fla., 50 tons per hr.

The concentrating plants of the Phosphate Recovery Corp. were the first in which flotation methods were used on phosphate on a commercial scale, and together with licensed plants are also believed to be the largest nonmetallic flotation operation in the world. The application of flotation for the recovery of phosphate has been of inestimable value to the phosphate industry. The amount of phosphate recovered from an average virgin deposit is double the amount formerly obtained by using other methods. Instead of 15 per cent., about 30 per cent. is now obtained at no increase in cost other than that of the operation of the flotation equipment. Mining, stripping and processing costs have all been materially lowered, as production has been doubled for the same amount of material handled. Flotation has also made available deposits formerly not considered of commercial value and has even made it profitable to rework waste dumps accumulated under former methods. The débris in these waste dumps contains phosphate grains of almost the same size and specific gravity as the quartz grains which form a large percentage of the waste. It is almost impossible to separate these two materials by mechanical means. Many virgin deposits also contain such large amounts of small phosphate particles that mechanical separation is not economically possible.

The development of the application of flotation in the phosphate industry began early in 1926, when John T. Burrows, vice president and manager of the mine department of the International Agricultural Corp., instigated an investigation of possible methods of saving the fine rock then being wasted by the washers. James A. Barr, chief engineer, and Charles E. Heinrichs were detailed to carry out the investigation. It was found that Minerals Separation North American Corp. al-



Some of the roughing cells and flotation machines in Plant No. 4.



One of the bowl-and-rake classifiers used in Plant No. 4.

OPPOSITE PAGE, TOP: Hydraulicking material for the No. 92 washer. Pump at left supplies washer. BOTTOM: The 24 cascade rougher cells in Plant No. 2.

Booster pump on pipe-line between No. 92 washer and No. 2 concentrator.

ready owned at least one patent covering the concentration of phosphate rock by flotation. An agreement was reached for joint development of a commercial method of flotation concentration and it was for this purpose that the Phosphate Recovery Corp. was formed.

After much experimentation a pilot plant was built in 1927 adjacent to the old No. 11 washer of the International Agricultural Corp., where current washer débris was available. Finally a satisfactory method was worked out. The reagent cost was at first a considerable item, but this was reduced by desliming prior to flotation and through the use of fuel oil or other petroleum oil in conjunction with fatty acids. It was also found that for the greatest efficiency the reagents should be added separately to a thick pulp and then diluted before actual flotation. Through the knowledge gained from experience the total reagent consumption has been brought down to an average of about 2½ lb. to the ton of feed.

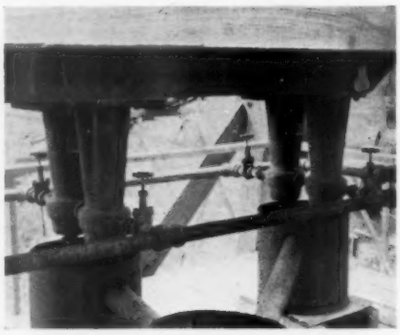
A well-equipped research laboratory is maintained for making all the necessary tests and for further improving the process. A continuous laboratory washing and flotation unit is used for this purpose.

The original No. 1 concentrator near Mulberry, Fla., was dismantled in 1934 and most of the equipment was moved to Pembroke, Fla., where is was used in the construction of the No. 4 concentrator to be described in this article.

The No. 2 concentrator of the Phosphate Recovery Corp. near Mulberry, Fla.

The No. 11 washer was then moved to a new location and is now known as the No. 92 washer. The débris from this washer goes to the No. 2 concentrator near Mulberry, built in 1930, which will also be described. This plant handles 100 long tons of feed per hr. and the No. 4 plant handles about 50 tons per hr. Both these plants supply sized and washed phosphate to the International Agricultural Corporation's immense drying plant at Mulberry. This drying plant was completed in 1931 and was described in an article published in the December 30, 1931 issue of PIT AND QUARRY. The No. 3 concentrator at Wales, Tenn. is operated intermittently. There the entire washer output is used as feed for the flotation plant. The No. 5 concentrator at Mt. Pleasant, Tenn., was built in 1935 and is similar in design to Concentrator No. 3. Each of these plants has a capacity of 20 tons per hr.

The No. 4 concentrator is supplied with material from several dumps of accumulated washer waste that were produced before flotation methods were used. These are among the few older dumps in the Florida pebble-rock field where overburden is not mixed with the washer waste. This early segregation of barren material from the valuable low-grade fines has made possible the reclamation of these fines at a much lower cost than would otherwise be the case.



Four of the six compound-funnel classifiers in Plant No. 4.

Instead of the usual hydraulicking methods, a suction dredge is used in reclaiming the material from these dumps. This method is more economical in this instance, because the bottom of the dump materials is about 20 ft. below the normal water level. This dredge is conventional in design and has a 10-in. Georgia Iron Works pump and a suction nozzle which can be

The No. 92 washer of the International Agricultural Corp., which supplies the No. 2 concentrator with hydroseparator at right.

raised and lowered or swung from side to side. From 175 to 200 cu. yd. of material is handled in an hour.

At Plant No. 4 the material is discharged into a 4-ft. by 12-ft. Georgia Iron Works trommel with ⅜-in. openings. The oversize is wasted by a Georgia Iron Works pump. The material passing through the screen is discharged into a launder under which are six Deister Machine Co. compound funnel classifiers. These remove some of the coarser material, which is fed to a pair of Link-Belt single-deck vibrating screens fitted with 14-mesh wire cloth. The material retained on these screens is discharged into cars as a finished product.

The material retained in the launder is discharged into four 22-ft.-diameter feed bins from which the overflow is wasted. These bins feed a 4-ft. by 10-ft. Allis-Chalmers rod-mill. The product of this mill and the undersize from the above vibrating screens are discharged into a 6-ft.-wide Duplex classifier by means of a 3-in. Wilfley pump.

The product of the rake section of the Duplex classifier is discharged into a 4-ft. by 10-ft. Marcy rod-mill, whose product is transferred by a 3-in. Wilfley pump into an 8-ft. by 20-ft. Dorr bowl classifier which also receives the overflow of the preceding Duplex classifier. The overflow of this last classifier goes to waste. The product of the rake section of this classifier is discharged into a 4-ft. by 20-ft. rotary conditioner in which the reagents—caustic soda, fatty fish acid and fuel oil—are added. The mixture then flows into a 4-ft. mixer. Two 16-in. vertical bucket-elevators feed two 4-cell, 24-in. flotation roughers which are of a new type with open dished runners. The rougher tailings are wasted.

The concentrate is discharged from these roughers into two 3-cell, 18-in. MS Sub-A flotation cleaners. These machines are double spitz, with wires located at the center of the dividing compartment between the cells, and discharge at both sides. Air is furnished at 1.25 lb. per sq. in. pressure by a centrifugal blower. The cleaned concentrate is discharged into an 8-ft.-wide dewatering drag. The drag product is elevated into three filter bins from which it is discharged into railroad cars for haulage to the drying plant. The tailings from the flotation cleaners, the overflow from the drag, and the filtrate from the filter bins are all transferred by a 4-in. Wilfley pump into a surge tank. This tank discharges these materials back into the bowl classifiers and the flotation roughers already mentioned. The waste is passed through a series of mined-out pits and canals until most of the suspended matter is settled out. The water is then returned for re-use in the plant.

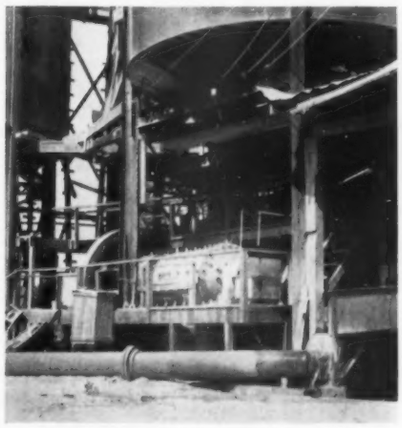
Another view of the No. 4 concentrator with filter bins for car loading at right.

The No. 4 concentrator of the Phosphate Recovery Corp. at Pembroke, Fla.

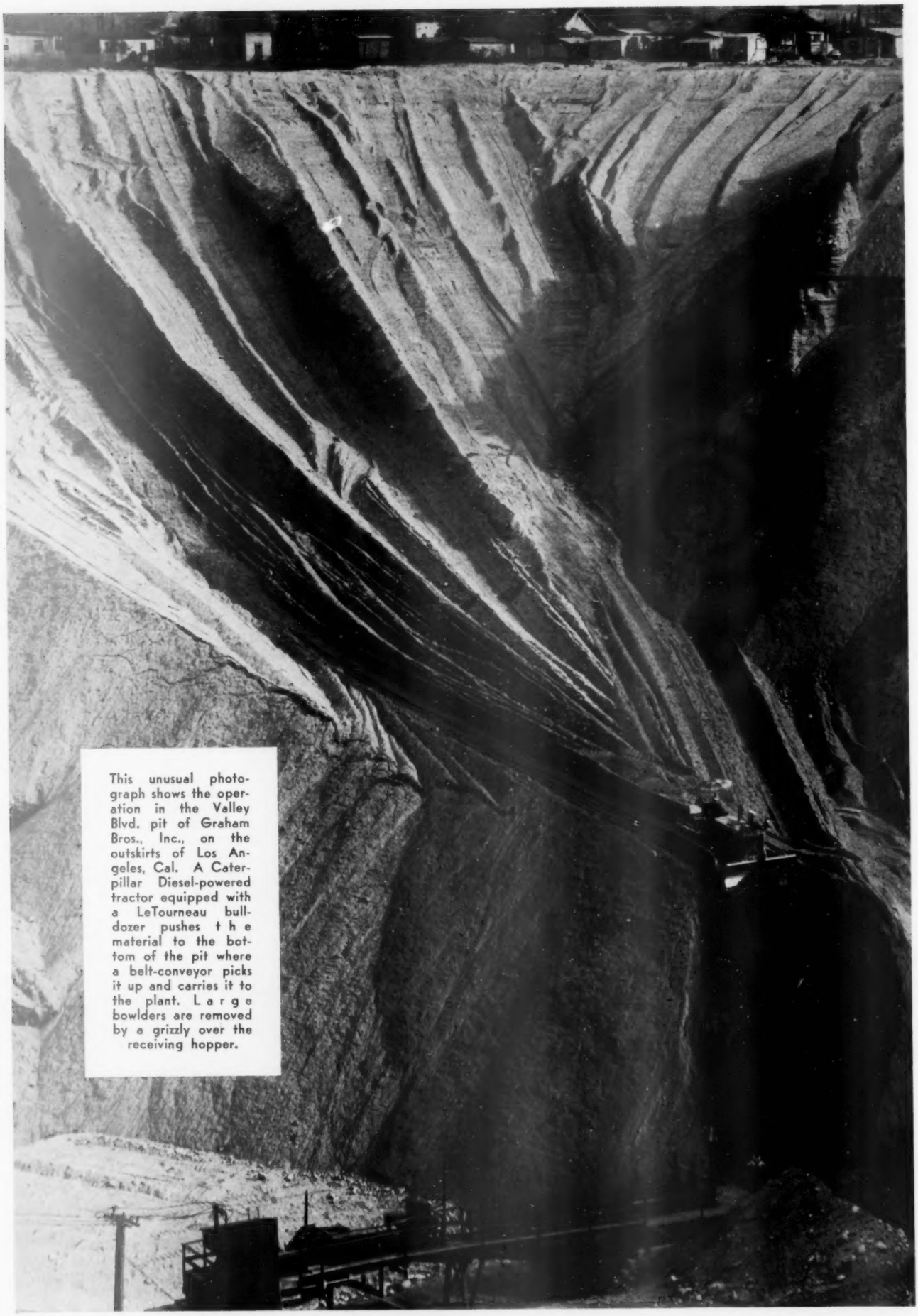
The No. 92 washer, which is served by the No. 2 concentrator, is supplied from virgin deposits. The character of these deposits and the methods used in removing the overburden and hydraulicking the matrix are common to this section and have been described in these pages several times in recent years (see PIT AND QUARRY, September, 1937, p. 41). A Bucyrus rail-mounted electric drag-line with a 165-ft. boom and an 8-cu. yd. bucket is used to remove the overburden. At the time this operation was visited by the writer three Georgia Iron Works hydraulicking guns or nozzles were in use in the pit. A 12-in. Georgia pump was used to pump the matrix and water a distance of 1,000 ft. to the No. 92 washer.

The No. 92 washer of International

(Continued on page 58)



One of the rod-mills in the No. 2 concentrator.



This unusual photograph shows the operation in the Valley Blvd. pit of Graham Bros., Inc., on the outskirts of Los Angeles, Cal. A Caterpillar Diesel-powered tractor equipped with a LeTourneau bulldozer pushes the material to the bottom of the pit where a belt-conveyor picks it up and carries it to the plant. Large bowlders are removed by a grizzly over the receiving hopper.

Confusing Diversity Exists Among States on Dust-Disease Liability

AS could easily be expected, the statutes and the court decisions which govern an employee's right to compensation or to damages on account of occupational disease show a confusing diversity from state to state, and even in a given state the problem is far from simple. Nevertheless, a notable study of the legal problems connected with the occupational-disease hazard in industry, with particular reference to dust problems and silicosis, has been made for and published by the Air Hygiene Foundation of America, Inc., under the general title of *A Survey of the Statutes and Court Decisions Respecting Occupational Disease from Air Pollution.*

This survey, published in six booklets, sets out to be "sufficiently comprehensive to indicate the general scope of the laws of each state and to facilitate a more intensive study thereof by one interested in the laws of any particular state". The following article attempts a concise and reasonably brief *resumé* of the general principles and conclusions developed by the Foundation's survey, and a tabulation of some of the pertinent information by states. Since the Foundation's survey was completed before the 1937 sessions of the legislatures were under way, the factual material is supplemented or revised editorially to include new laws and amendments enacted during 1937.[1]

In spite of the diversity of laws and decisions, two questions easily stand out as of prime importance in approaching the problem in any given state: (1) whether occupational diseases are compensable under a workmen's compensation act or occupational-diseases act, and (2) whether there is a common-law right of action on account of occupational disease.

Common-Law Liability.—Common-law liability may be considered as the underlying question, which may be modified in some respect by the statutes. It is at once important and difficult to state concisely. In many states there appears to have been no occasion for the courts to decide whether or not the right exists at common law to recover for occupational disease due to negligence of the employer. In other states, where the right existed, it has been materially modified by the passage of compensation acts.

Roughly speaking, the common law is the law as defined and announced by court decisions, rather than any express constitutional or legislative provisions (which, if they exist, prevail). In the case of occupational disease, including silicosis and other ailments due to exposure to dust or other form of air pollution, even where such ailments are not compensable under a workmen's compensation law, and even though a particular operation may not be covered by any statutes of the state concerned, the circumstances may be such as to give rise to the right of an employee to recover against the employer, on the theory that the employer was negligent, that is, remiss in some duties which he owes to the employee. This would be a recovery under the common law.

Definition of Occupational Disease.—According to some courts, an occupational disease is a disease which is normally incident to a particular occupation, and which could not have been prevented by any amount of care on the part of either the employer or the employee. (Definition No. 1.)

The view of other courts is that an occupational disease is one peculiar to certain occupations, or to occupations having the same type of hazards, and which is sufficiently well recognized that precautions can be exercised to prevent its occurence. (Definition No. 2.)

Now, it is axiomatic that under the common law recovery must be grounded on negligence of the employer; hence, for occupational disease as defined in Definition No. 1, there can be no recovery at common law, for the obvious reason that it does not result from negligence of the employer. (Where workmen's compensation laws cover occupational disease, an award in most cases would be made, since the right to recover under such statutes would not be predicated upon negligence.)

As a general rule, the employee has the right at common law to recover damages for occupational disease as defined in Definition No. 2, if it can be shown that the disease resulted from the negligence of the employer and if the employee has done nothing himself to bar his right of recovery.

Recovery Based Upon Negligence.—At common law the employee has no right to recover damages from his employer for personal injury, *i.e.*, either traumatic injury or occupational disease, unless the employer is guilty, in some manner, of negligence. Negligence of the employer may consist either of the commission of some act or of the failure to act.

It is well settled at common law that the employer owes the employee the duty to furnish him a reasonably-safe place in which to work and reasonably-safe instrumentalities with which to work. This does not mean that the employer insures the safety of the place of employement, but he must use reasonable care and prudence to see that it is safe. Ordinarily the employer is charged with a higher degree of knowledge of the dangers incident to the employment than is charged against the employee. If the employer knows of dangers incident to the employment, it is his duty, not only to take precautions against those dangers, but also to warn the employees of the dangers. His failure so to warn is usually considered negligence.

The duty of the employer to provide a safe place in which to work and safe instrumentalities with which to work will change and increase with the employer's knowledge of his business. What is to-day reasonable care in a certain industry may not be reasonable care to-morrow in the light of facts developed by research or of increased knowledge of dangers lurking in the business. A few years ago the extent of the danger of exposure to certain dusts may have been unknown both to industry and to medical science. Consequently there would have been no

[1]Since preparation of this article, the summary chapter of the Air Hygiene Foundation's survey has been reprinted as a supplement to include these developments of 1937.—*Ed.*

common-law right of action by one injured through exposure to such dusts. If to-day the effects of inhaling such dusts are known, it becomes the duty of the employer to take reasonable precautions to protect the employees against those dangers, and failure to do so would constitute negligence giving rise to a common-law action. The common law develops with human experience and to a large degree keeps abreast of the times. The basis of liability, however, never changes—recovery must be based upon negligence of the employer, which is the failure of the employer to use reasonable care for the protection of the employee.

Where dust hazards are involved, the exercise of reasonable care on the part of the employer requires him to use modern and efficient means of testing the degree of air pollution and to use modern and efficient means of ventilation. There are several recognized methods of taking a dust count, and doctors and engineers are fairly well in agreement as to the quantities of dust of various kinds which can safely be tolerated in a place of employment. An employer can not fail to make adequate tests and expect a jury to absolve him from a charge of negligence. If the operations are such that the degree of air pollution can not be reduced to a point of safety, the exercise of reasonable care would require that dust guards, masks or respirators be furnished the workmen. All such equipment must, of course, be of proved efficiency. Furthermore, the employer must see that such equipment is maintained in good condition and that it is actually used. The duty of the employer is not fulfilled with the furnishing of individual protective equipment, if he permits or countenances the failure of the employees to use the equipment. The general tendency of jury verdicts and court decisions is to hold the employer to a higher degree of care in these regards. This does not mean that an employer must adopt all new devices, but he must be able to show that the device and equipment which he used and which he furnishes to the employees are adequate for their intended purpose, and are such as reasonable persons would employ under the circumstances. If equipment admittedly better than he is using is available, it will be extremely difficult for him to convince a court and a jury that he has exercised due care unless he has adopted such equipment.

Because of its relation to the subject of common-law liability, it should be noted that the violation of any statutory requirement as to working con-

SUMMARY OF THE LAWS AND COURT DECISIONS AFFECTING OCCUPATIONAL DUST DISEASES, BY STATES—Part I

State	Common-Law Right of Action for Damages, Based on Employer's Negligence	Compensability Under Workmen's Compensation or Occupational-Diseases Acts
Alabama	Probable	No; disease is compensable only if resulting from an accident (**Law:** Code, Sec. 7596 (j). **Leading Case:** 109 So. 360.)
Arizona	Uncertain	No; disease is compensable only if resulting from an accident (**Law:** Code, Sec. 1420. **Leading Case:** 26 Pac. (2d) 1017.)
Arkansas	Probable	(No compensation law.)
California	Limited by compensation law	Any disease arising out of the employment is compensable. (**Law:** General Laws, Act. No. 4749, Sec. 3, amended.)
Colorado	Uncertain	No; only accidental injury is compensable. (**Law:** Compiled Laws, Sec. 4389. **Leading Case:** 194 Pac. 625.)
Connecticut	Doubtful	Occupational disease is compensable. (**Law:** Gen. Stats., Sec. 5223.)
Delaware	Probable	Specified "compensable occupational diseases" are covered, but silicosis is not included. (**Law:** Chap. 241, Laws 1937.)
Florida	Uncertain	No; only accidental injury is compensable. (**Law:** Chap. 17481, Laws 1935.)
Georgia	Possible	No; disease is compensable only if resulting from an accident. (**Law:** Code, Sec. 114-102. **Leading Case:** 157 S. E. 260.)
Idaho	Uncertain	Disease is not compensable unless resulting from injury. (**Law:** Code, Sec. 43-1810); but "personal injury" by accident has been liberally construed. (**Leading Cases:** 275 Pac. 1114; 6 Pac. (2d) 856; 33 Fed. (2d) 1.)
Illinois	None	Workmen's Occupational-Diseases Act. (**Law:** House Bill No. 10, Laws 1935, 3d Spec. Sess.)
Indiana	Probable; limited by Occupational-Diseases Act.	Workmen's Occupational-Diseases Act. (**Law:** Chap. 69, Laws 1937.)
Iowa	Probable	No; disease is not compensable unless resulting from accident. (**Law:** Code, Sec. 1421. **Leading Case:** 176 N. W. 823.)
Kansas	Well settled	No; only accidental injuries are compensable. (**Law:** Rev. Stats., Sec. 44-501. **Leading Case:** 233 Pac. 800.)
Kentucky	Limited by compensation law	Compensation law applies to specified diseases, including silicosis, upon election. (**Law:** Stats., Sec. 4880.)
Louisiana	Well settled	No; disease is not compensable unless resulting from injury. (**Law:** Gen. Stats., Sec. 4392. **Leading Cases:** 4 La. App. 524; 154 So. 406.)
Maine	Probable	No; only accidental injury is compensable. (**Law:** Rev. Stats., Chap. 55, Sec. 8. **Leading Case:** 142 Atl. 865.)
Maryland	Probable	Only disease resulting from injury is compensable, but "accidental injury" has been liberally construed. (**Law:** Code, Art. 101, Sec. 65 (6). **Leading Cases:** 128 Atl. 635; Atl. 134.)
Massachusetts	Probable	"Injuries" (compensable under Gen. Laws, Chap. 152, Sec. 26) have been construed to include occupational diseases, including silicosis. (**Leading Cases:** 180 N. E. 228, and others.)
Michigan	None	Specified occupational diseases, including silicosis, are compensable. (**Law:** Pub. Acts. 61, laws 1937.)
Minnesota	Limited by compensation law	Specified occupational diseases, not including silicosis, are compensable. (**Law:** Stats., Sec. 4327.)
Mississippi	Well settled	(No compensation statute.)
Missouri	Limited by compensation law	Compensation law applies to occupational diseases, upon employer's election. (**Law:** Rev. Stats., Sec. 3305 (b) and 1931 amendment.)
Montana	Uncertain	No; "injury" is distinguished from the contracting of a disease. (**Law:** Rev. Codes, Sec. 2870.)
Nebraska	Limited by compensation law	Certain occupational diseases, not including silicosis, are compensable. (**Law:** Chap. 107, Laws 1937, amending Sec. 48-152(b).)
Nevada	Uncertain	Only accidental injuries are compensable. (**Law:** Compiled Laws, Sec. 2680.)
New Hampshire	Well settled	No; only accidental injuries are compensable. (**Law:** Pub. Laws, Chap. 178. **Leading Case:** 170 Atl. 769.)
New Jersey	Limited by compensation law	Specified occupational diseases, not including silicosis, are compensable. (**Law:** Compiled Stats., and Suppl., Sec. 236-27.)
New Mexico	Uncertain	Only accidental injuries are compensable. (**Law:** Chap. 178, Laws 1933, amending Sec. 156-102.)
New York	Limited by compensation law	Silicosis is compensable under Art. 4a of the Workmen's Compensation Act, added by Chap. 887, Laws of 1936; other diseases are compensable under other portions of the act.
North Carolina	Uncertain	Specified occupational diseases, including silicosis, are compensable. (**Law:** Chap. 123, Laws 1935, Sec. 50½.)
North Dakota	Excluded by compensation law	"Any disease proximately caused by the employment" is compensable. (**Law:** Compiled Laws. Supp., Sec. 396a2.)
Ohio	None	Specified occupational diseases, including silicosis, are compensable. (**Law:** Gen. Code, Sec. 1465-68a, amended.)

SUMMARY OF THE LAWS AND COURT DECISIONS AFFECTING OCCUPATIONAL DUST DISEASES, BY STATES—Part II

State	Common-Law Right of Action for Damages, Based on Employer's Negligence	Compensability Under Workmen's Compensation or Occupational-Diseases Acts
Oklahoma	Probable	Only accidental injuries are compensable. (**Law:** Stats., Sec. 13350 (7).) Occupational disease is not compensable. (**Leading Case:** 293 Pac. 773); but injury from inhaling cement dust has been compensated as "accidental injury". (**Leading Cases:** 4 Pac. (2d) 1061; 27 Pac. (2d) 1041.)
Oregon	Probable	Only accidental injury "caused by violent or external means" is compensable. (**Law:** Gen. Laws, 1935 Supp., Sec. 49-1827. **Leading Case:** 265 Pac. 990.)
Pennsylvania	Probable	Occupational Disease Compensation Act (Act No. 552, Laws 1937; supplement to Workmen's Compensation Act; effective Jan. 1, 1938) applies to silicosis and other specified diseases.
Rhode Island	Probable	Specified diseases, not including silicosis, are compensable. (**Law:** Chap. 2358, Laws 1936.)
South Carolina	Uncertain	Disease is not compensable unless resulting naturally and unavoidably from an accident. (**Law:** Act. No. 601, Laws 1935, Sec. 2 (f).)
South Dakota	Uncertain	Disease is not compensable unless it results from an injury. (**Law:** Compiled Laws, Sec. 9490. **Leading Case:** 207 N. W. 89.)
Tennessee	Probable	Disease is not compensable unless it results naturally from an injury. (**Law:** Code, Sec. 6852 (d). **Leading Case:** 247 S. W. 989.)
Texas	Doubtful	Disease is compensable only when naturally resulting from injury. (**Law:** Stats., Title 130, Art. 8306. **Leading Case:** 284 S. W. 931.)
Utah	Uncertain	Disease is compensable only when resulting from injury. (**Law:** Rev. Stats., Sec. 42-1-42. **Leading Case:** 206 Pac. 278.)
Vermont	Uncertain	Disease is compensable only when resulting from injury. (**Law:** Pub. Laws, Sec. 6485.)
Virginia	Probable	Disease is compensable only when resulting naturally and unavoidably from an accident. (**Law:** Code, Sec. 1887 (2) (d). **Leading Case:** 124 S. E. 271.)
Washington	Limited by compensation law	Specified diseases, including "any persons employed in any industry where intense dust prevails," are compensable. (**Law:** Chap. 212, Laws 1937, adding Sec. 7679-1.)
West Virginia	Limited by compensation law	Silicosis is compensable, upon employer's election. (**Law:** Chap. 79, laws 1935.)
Wisconsin	Limited by compensation law	Occupational diseases are compensable. (**Law:** Stats., Sec. 102.01, subd. 2.)
Wyoming	Uncertain	Disease is not compensable unless directly resulting from an injury. (**Law:** Rev. Stats., Sec. 124-106-7 (m)); but "injury" has been liberally construed and silicosis compensated. (**Leading Case:** 52 Pac. (2d) 690.)

ditions or safety devices constitutes negligence *per se* and the employee has a right of action for damages resulting from such violation.

Assumption of Risk; Contributory Negligence.—The usual defenses of the employer are that the employee assumed the risk of the employment or that the employee was guilty of contributory negligence. Either defense, if proved, constitutes a bar to recovery by the employee.

It is a well-established principle of law that an employee usually assumes those risks which are ordinarily incident to the discharge of his duties in the particular employment, and those not ordinarily so incident but of which he has actual or constructive knowledge with full appreciation of the dangers that may flow therefrom. Most industrial employment involves certain dangers which are inherent in the operation and which no amount of care can eliminate. Such risks the employee ordinarily assumes, and he can not recover damages if he is injured by reason of such dangers. It can not be said, however, that he assumes the risk of dangers of which he does not know. It is therefore manifest that the assumption of risk is difficult to establish with respect to injuries to health suffered through long-continued inhalation of polluted air, for it is difficult to establish that the employee had sufficient knowledge of such danger.

Negligence of the employee which contributed proximately to the injury or physical condition of which he complained will bar recovery. In cases arising out of the breathing of polluted air, contributory negligence would consist of remaining at work with knowledge of the conditions and dangers. Therefore, for practical purposes, contributory negligence does not differ materally from assumption of risk in such cases.

In practically all the statutes prescribing measures or devices designed to protect employees the defenses of assumed risk and contributory negligence are denied the employer in the event the statutes are violated and accident or injury results.

Common Law; Summary.—The foregoing are submitted by the Foundation's survey only as general statements of common-law principles. The extent to which statutes have modified the common law must be determined by a study of the laws of the individual states. Furthermore, where several states have statutes of almost identical wording, they may be construed differently by the courts of the respective states.

As a rough summary and classification (submitted with the emphatic caution that the law of each state must be carefully studied, and that lawyers might well differ as to where any particular state belongs in such classification), the survey concludes:

First, the states in which the courts have held that no such common-law right to recover for occupational disease due to the negligence of the employer exists are Illinois, Michigan and Ohio. North Dakota is probably to be included in this group, not because the common-law right never existed there, but because if it ever existed, it has been completely surperseded by the workmen's compensation act, the remedies under which are exclusive (the employee has only such rights as are given by the workmen's compensation act; occupational disease is compensable).

States in which the common-law right of recovery is considered extremely doubtful are Connecticut and Texas. In Georgia common-law recovery has been held to be excluded by the workmen's compensation act, even as to disabilities which are not compensable thereunder, and occupational disease is not compensable (in most states it is held, where an injury is not compensable, that the statute does not affect any common-law rights that exist in relation thereto); however, new safety legislation enacted in 1937 may change this situation.

The common-law right to recover for occupational disease caused by the negligence of the employer is considered probably to exist, although there is some doubt, in Arkansas, Delaware, Georgia, Indiana, Iowa, Maine, Maryland, Massachusetts, Oklahoma, Oregon, Pennsylvania, Rhode Island, Tennessee, Virginia and Washington. (However, a 1937 Washington statute makes occupational diseases compensable under the workmen's compensation act, the remedies of which are exclusive; also a Pennsylvania statute effective Jan. 1, 1938, makes occupational diseases compensable; and some are compensable under a new Delaware law).

It seems well settled that such a right does exist in Alabama, Cali-

fornia, Kansas, Kentucky, Louisiana, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Jersey, New York and West Virginia. However, occupational disease is compensable, to some extent, under compensation acts, and the common-law right is consequently very much limited, in all these states except Kansas, Louisiana, Mississippi and New Hampshire.

In the states of Arizona, Colorado, Florida, Idaho, Montana, Nevada, New Mexico, North Carolina, South Carolina, South Dakota, Utah, Vermont, Wisconsin and Wyoming, and in the District of Columbia, no court decisions which decide the question as to whether or not such common-law liability exists were found. In the District of Columbia, North Carolina and Wisconsin occupational disease is compensable under compensation statutes.

Workmen's Compensation Acts.—In almost all states where provision is made for compensation for disability or death due to occupational disease the statutes are in the form of amendments or supplements to the workmen's compensation acts. Two states where this is not true, but which have occupational-disease acts separate from the workmen's compensation acts, are Illinois and Indiana. The Illinois law went into effect Oct. 1, 1936, and the Indiana law on June 7, 1937. These laws are exclusive in their remedies for disability or death resulting from occupational diseases; that is, liability is limited to compensation under the terms of the act, or to damages in an action brought under the provisions of the act in case the employer has not elected to provide and pay compensation.

Workmen's compensation laws are of much longer history. Wisconsin's is the oldest, dating back to 1911; others are very recent. There is considerable variation in these laws as to the compensability of occupational diseases; the laws also vary greatly in such matters as whether the statute is compulsory or elective, the type of fund provided, etc.

The guiding principle of the early workmen's compensation acts was the awarding of compensation for accidental injury, meaning thereby traumatic injury. In those years the importance of disability due to occupational disease was not generally recognized. However, it became increasingly apparent that "injury" might be suffered gradually, and that the result of such gradual breaking down of the strength and resistance of the employee was more serious in many instances than traumatic injury. Courts in some states, therefore, wrestled with the problem of construing "injury" so as to include disease and bring disease within the compensation laws. An outstanding example is the Maryland decision of 1925 in *Victory Sparkler & Specialty Co. v. Francks* (128 Atl. 635, 147 Md. 368, 44 A.L.R. 363). The court held in that case that phosphorus poisoning resulting from exposure over a period of years came within the term "accidental injury" because the injury was suffered by chance, that is, not foreseen or anticipated by the injured person, and found that the condition resulted from the negligence of the employer. By this reasoning the court held that the particular disability was compensable, although it held it not to be an occupational disease. It was merely an "accidental injury". The result seems to be that in Maryland a diseased condition is compensable, if caused by the negligence of the employer.

In many instances the compensation statutes originally enacted have been amended or supplemented so as to cover occupational diseases.

Leaving Maryland in a class by itself, it is found that occupational disease is compensable, to some extent, by statute or by judicial construction, in California, Connecticut, Delaware, Illinois, Indiana, Kentucky, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, New Jersey, New York, North Carolina, North Dakota, Ohio, Pennsylvania, Rhode Island, Washington, West Virginia and Wisconsin (Delaware, Indiana, Michigan, Pennsylvania and Washington are new to this list in 1937). In Delaware, Minnesota, Nebraska, New Jersey and Rhode Island silicosis is not included among the compensable diseases. In West Virginia silicosis is the only occupational disease which is made compensable.

It should be noted also that the labor laws and factory-inspection laws of the various states recognize the legal obligation to provide a safe place to work, and ordinarily the matter of ventilation is featured. Failure to comply with these laws results in liability of the employer, and frequently also in penalties. These laws are not covered in the appended summaries.

Air Hygiene Foundation Reviews Advance in Industrial Health

APPROXIMATELY 250 persons, including industrial leaders, technical specialists, governmental officials, physicians and engineers attended the meeting of Air Hygiene Foundation at Mellon Institute, Pittsburgh, Pa., on Nov. 30. The assembly heard reports by the Foundation's medical, engineering and legal committees on recent advances toward the control of occupational disease and on current developments in the field of industrial health.

H. B. Meller, managing director, announced that the Foundation has recently arranged for scientific investigations at the Saranac Laboratory, the University of Pennyslvania and the Harvard School of Public Health. He said that more than 190 companies are now affiliated with the organization, a non-profit, industry-wide movement, supporting coördinated research to combat air-borne industrial disease.

Col. Willard T. Chevalier of New York, in a non-technical address to executives, said the meeting indicated industry's recognition of "social values as a very definite concern of its stewardship".

"It is necessary for industry to think not only of how much it costs to get a day's work out of a worker, but also how long a useful life will that worker have, what kind of health will he enjoy, what kind of consumer will he make for the goods and services produced by other industries."

"Look beyond to-day's cost sheets", he urged, asserting that the assumption of greater social responsibility on the part of industry, toward the worker and toward the community, is the best antidote for trends toward collectivism and community interference in business.

Col. Chevalier, vice-president of the McGraw-Hill Publishing Co., recalled that after the passage of the Workmen's Compensation Laws industry set out to eliminate accidents. Safety engineering, a new branch of science, was developed. The accident rate was sharply reduced. Similar forceful coöperation and united action was advocated by other speakers as the effective way to combat occupational diseases, now being made compensable in many states.

Prof. Philip Drinker of Harvard, chairman of the Foundation's Preventive Engineering Committee, reported that "one of the most significant developments in the field of occupational

hygiene during the past year has been the adoption of New York State's code governing dustiness in rock drilling.

"This code divides all rock formations into two classes, Class I being those with less than 10 per cent. free silica by weight, and Class II being those with more than 10 per cent. free silica. If drilling is done in class I rock, dust counts must be below 100,000,000 per cu. ft. and below 10,000,000 particles if the rock falls in Class II.

"This means, in effect, that dry drilling can only be used with local exhausts and adequate air cleaning. It happens, also, that wet drilling without ventilation will not achieve adequate air cleanliness in the case of the high quartz or Class II rock.

"At this writing it seems very likely that other states will copy this code almost verbatim. After all, New York adopted it as the result of extensive investigation and hearings and it is unlikely that other states will assemble better information on which to base their codes. It is probable that substantially this same code will be adopted for dust exposures of all kinds. If so, it will mean that the upper limit of dustiness in any kind of work and in any kind of dust will be 100,000,000 particles per cu. ft."

Dr. A. J. Lanza, chairman of the Foundation's medical committee, stated that a great deal of work is being done and that there is a clearer understanding of the problems "of industrial hygiene".

"Various tests are coming to the fore in the effort to determine the presence of possible occupational illnesses. Briefly, there has been developed a fairly accurate test to determine whether the individual is being exposed to dangerous quantities of benzol, known as the 'urine sulphate test'. Skin tests for allergic reactions among workers exposed to various substances are being developed more and more. Blood tests, particularly those of the nature which depend upon the differential counts of blood corpuscles, are becoming more and more important and more widely used. Research work is still being done in the effort to develop means of detecting the degree of impairment in pulmonary dust diseases, a very important phase, of course, of the compensation question.

"A group of hazards that has been attracting a great deal of attention, particularly in the last year, is that large number of chemical substances that are grouped under the name of solvents. The Massachusetts Department of Labor and Industry, I understand, is about to develop a rather comprehensive list of permissible concentrations in the atmosphere of working places of these various substances that are grouped loosely under the head of solvents.

"So this question is a live one. It is growing in importance, because the manufacture of chemicals in this country is on the increase and has been ever since the war conditions put an end to the importation of German chemicals and developed the chemical industry in this country."

Discussing the effects of various dusts upon the health of workmen, Dr. Lanza said there is evidence that combinations of dusts "act differently from any of these dusts when inhaled by themselves. That opens quite a field for speculation. The same thing has been observed, for instance, with gases. Dr. N. R. Mayerc, of the New York Division of Industrial Hygiene, has shown that, for instance, carbon monoxide when inhaled in combination with hydrogen sulphide is more dangerous than either carbon monoxide or hydrogen sulphide when inhaled alone.

"There is also a growing interest in the subject of cancer as a possible result or as possibly being associated with industrial hazards. With respect to dust inhalation, all the evidence is negative; that there is no particular relationship between the inhalation of dust and the incidence of cancer. Other forms of irritants, gases, fumes, and so forth, may have some such effect. That topic is a live one and is being investigated, as is also the possibility that fungus diseases of the lungs perhaps are more common than we have supposed."

Dr. LeRoy U. Gardner, of the medical committee, discussed the research he is undertaking for the Foundation at the Saranac Laboratory on "mixed" dusts and "protector" dusts. He said, "The evidence now available makes it seem improbable that a silica hazard is defined solely by the number and size of the silica particles in industrial atmosphere. The other components of a dust modify its action. Some may inhibit, others retard and perhaps some will be found to prevent its injurious effects. Because these possibilities are recognized it becomes difficult to set up definite standards of permissible dustiness in industrial atmospheres.

"Not enough is known about the action of protector substances to warrant the recommendation that they be employed to prevent silicosis in industry. Our aim should be to reduce existing dust concentrations rather than to increase them by adding more dust. I would very strongly oppose the recommendation that protector dusts be used to attempt to prevent silicosis at the present time. But I do believe that we should attempt to discover more about their action. Some, like gypsum, seem to combine with the silica in the atmosphere, forming clumps which are too heavy to remain suspended in air and too large to pass the barriers of the nose and upper respiratory tract. With such information at hand it may be possible to apply the knowledge in a practical manner."

The projects at the Saranac Laboratory and the University of Pennsylvania constitute the continuation and advancement of fundamental work which has been accomplished at these institutions in the past.

Daniel Harrington, a member of the Foundation's board of trustees and chief of the health and safety branch, U. S. Bureau of Mines, summed up "the whole matter of drilling" as follows:

"Dry drilling is, of course, very much more of a dust producer than wet drilling—probably in the ratio of 6, 8, or possibly 10 to 1. Wet drilling produces some dust. But if reasonable precautions are taken with wet drilling and suitable precautions are also taken as to the ventilation, as to the wetting of the muck pile, as to the time at which the blasting is done, as to the precautions which are taken after going back to the face after blasting, we feel —in fact we know—that under the present-day conditions mines can be so conducted that there need be no particular harm to workers in those places as far as dust diseases are concerned."

T. C. Waters, chairman of the Maryland occupational-disease commission and a member of the legal committee, reviewed a forthcoming critical analysis of compensation legislation which he has compiled for the Foundation and which will be issued in the near future. He stated that "During the past year occupational disease amendments to existing Workmen's Compensation Laws have been enacted in six states: Delaware, Indiana, Michigan, Pennsylvania, Ohio, and Washington. To-day there are 21 states whose laws provide compensation for occupational diseases. State commissions have been appointed for the purpose of studying and recommending compensation in eight other states: Alabama, Arizona, Georgia, Kansas, Maine, Maryland, New Mexico, and Oregon. In the course of the next few years all the industrial states probably will have enacted laws for this purpose."

More than 100 companies were represented at the meeting.

A.I.M.M.E. DISCUSSES ECONOMIC PROBLEMS

J. R. Thoenen, Bureau of Mines Executive, Chosen Chairman of Industrial-Minerals Division.

ECONOMIC problems affecting the nation and specifically the mineral industry were given prominence at the 148th meeting of the American Institute of Mining and Metallurgical Engineers held in New York February 14 to 17. R. C. Allen, the president of the institute, introduced a general session on mineral economics by blaming the technicians for overlooking entirely the economic aspects of their professions. He admitted that technical problems are important but he contended that, particularly during the last decade, social, economic and political issues are of far greater consequence.

Mineral Economics.—H. G. Moulton[1], president of the Brookings Institution, spoke at some length on the interrelations of technology, economics and government in a balanced and progressing economy. Dr. Moulton commented on the doctrine advanced by many that science has brought us to a goal of plenty and that restrictions are now necessary. In his opinion the United States needs all the aid that science can render for decades to come to develop new wealth. He felt that a law to limit hours would limit progress and would be a serious menace to the future advance of the nation. The solution, in his opinion, is in business policies which will insure increases in mass purchasing power comparable to productive efficiency. Constant improvement of technology resulting in lower costs is desirable and the benefits derived therefrom must be broadly disseminated among the masses. Dr. Moulton was specific in his conclusion that lowering prices is the only way to increase automatically the buying power of everyone. Increased wages is not a satisfactory solution because of the multitude of persons who derive their income through sources other than wages.

Dr. Moulton was followed by Leo Wolman[2], professor of economics at Columbia University, who is remembered by many as the head of the Labor Advisory Board during the N.R.A. period. Dr. Wolman presented convincing statistics to show that the recovery from the recent depression was the first in history that did not re-employ substantially all the unemployed. He showed that there has been a sharp rise in wages during the past four years and that the 1937 levels in many industries are considerably higher than those at 1929. At the same time, however, there has been a definite drop in the hours of employment. In closing his talk Dr. Wolman quoted an Austrian economist but without attempting to draw a definite parallel in the United States. "Austria was successful in pushing through policies which are popular all over the world. Austria has a most impressive record in five lines: she increased public expenditures, she increased wages, she increased social benefits, she increased bank credits, she increased consumption. After all these achievements she was on the verge of ruin."

The Industrial Minerals Division of the institute, headed by Chester A. Fulton, president of the Southern Phosphate Corp., presented an interesting and varied program. The first session was combined with that of the Mining Methods Committee of the institute, but most of the papers[3] included on the program had previously been given at the Washington meeting of the Division in October, 1937 (PIT AND QUARRY, November, 1937, p. 55). In addition, the Bald Eagle Magnesite Mine in California was described by Joseph B. Perry and G. M. Kirwan[4] of the Westvaco Chlorine Products Corp., and F. L. Serviss of Purdue University presented an interesting history of limestone mining in Indiana.

Ottawa Sand.—G. A. Thornton of the Ottawa Silica Co. was not present to read his paper on the preparation of silica sand as a raw material for the manufacture of chemical products, but it attracted considerable interest. Mr. Thornton particularly stressed the point that the preparation of Ottawa sand begins at the quarry. The sand, which is mixed with a little clay, is sluiced down by hydraulicking. Although the primary purpose of the hydraulic method is in mining, it is also of considerable importance in breaking lumps and for preliminary washing. The sand is then pumped to plants on the top of the cliff, as much as 2,000 ft. away, and the scouring action in the pipe-line also aids in removing part of the clay. In the plant itself the washing is continued with water supplied by artesian wells.

No crushing is necessary for most of the products shipped by the company, although considerable pulverized silica is produced in pebble mills. The typical size of the run-of-plant material after washing is 100 per cent. through 14-mesh and 95 per cent. retained on the 100-mesh screen. About 15 grades of Ottawa sand are commonly marketed. The variation in grade is solely that of screen analysis. The prices range from $1.35 to $3.50 a ton f.o.b. plant, the coarsest grades bringing the highest prices. A typical blast sand used largely by foundries for cleaning castings is so coarse that 35 per cent. is retained on the 28-mesh screen and 96 per cent. on the 40-mesh. Among the fine grades only a trace is retained on the 48-mesh and only 38 per cent. on the 100-mesh, with 6 per cent. passing the 200-mesh.

More than half the output of the company is used in the manufacture of glass but the rest finds its way into a wide variety of uses. The A.S.T.M., for example, specifies Ottawa sand for test specimens of cement mortars as well as briquets for determining tensile strength.

Phosphate-Rock Washing.—At a previous meeting of the Industrial Minerals Division the mining and drying of phosphate rock were included on the program. J. W. Pamplin[5] of the Southern Phosphate Corp. made a further contribution to the information on phosphate-rock production by presenting a detailed description of the ore-dressing practice of his company. He introduced his paper as follows:

"The problem confronting the ore-dresser in the pebble-phosphate field

[1] Moulton, H. G.—*Interrelations of Technology, Economics, and Government in a Balanced and Progressing Economy.* Mimeograph. 11 pp.

[2] Wolman, Leo.—*Labor and Capital.* Mimeograph. 5 pp.

[3] Severinghaus, Nelson.—*Drilling and Blasting Practice of Consolidated Quarries Corp.* A. I. M. E. Tech. Pub. 878, 11 pp.

Sheppard, Mark.—*Hydraulic Stripping of a Stone Quarry.* A.I.M.M.E. Tech. Pub. 879, 8 pp.

Smith, R. W.—*Limestone Mining at Ste. Genevieve, Mo.* A.I.M.M.E. Tech. Pub. 902, 23 pp.

[4] Perry, J. B. and Kirwan, G. M.—*The Bald Eagle Magnesite Mine, Cal.* A.I.M.M.E. Tech. Pub. 861, 15 pp.

[5] Pamplin, J. W.—*Ore-dressing Practice with Florida Pebble Phosphates, Southern Phosphate Corp.* A.I.M.M.E. Tech. Pub. 881, 19 pp.

is, first, to rid the phosphate pebble of all clay, then to separate the finer phosphate pebble from quartz of the same sizes.

"The first operation is partly accomplished in the rock line as the matrix comes to the washer. It is further accomplished by trommels, which remove the large clay balls; by log-washers, which break up the smaller clay balls; and by Hardinge mills, which slime the fine clay balls. Dorr deslimers and Allen tanks remove the slimed clay and the very fine sands to waste.

"The plus 14-mesh and the minus 14- plus 20-mesh fractions are clean phosphate pebble. The former is of lower grade because of its higher silica content, but in either case this silica is a part of the pebble. In the very coarse sizes, plus ½-in., it may often be seen as veinlets, while in the finer sizes it is microscopically invisible. Below 20-mesh quartz grains commence to 'dilute' the phosphate pebble, in increasing amounts as the size decreases. With the clay in suspension as slime, it is easy to separate the plus 5-mesh pebble by screening, and the plus 20-mesh (and sometimes finer) by hindered-settling classification.

"The second problem then is to separate the phosphate pebble from the free quartz. This is done by selective concentration, for the difference in specific gravity between the two is so slight that ordinary gravity concentrating methods can not be used.

"Many of the plants in the field use flotation cells, with a reagent treatment that includes bringing the pH of the feed to the recovery plant from around 7 up to 8.0 or 8.5; a reaction on the surface of the pebble between the lime in the pebble and a fatty or resinous acid (or both); then a filming of the pebble with petroleum oil; and the addition of a frother to aid in the levitation of the phosphate pebble. However, for such a treatment the plus 35-mesh pebble must be ground, if flotation tailings are to be kept below 10 per cent. B.P.L. In most of the high-grade phosphate pebble deposits the pebble is extremely soft and such preflotation grinding results in much phosphate sliming. As most of the minus 100-mesh fractions (including such phosphate slime) are classified out prior to the flotation treatment, this adaptation of an excellent method for fine sizes, to the treatment of coarse sizes, often results in high phosphate losses not apparent by the usual 'heads minus tails' calculation.

"Considerable work was done by the Bureau of Mines and by the writer in 1932, first independently and later jointly, on the tabling of this mixture of phosphate pebble and quartz in the minus 20-mesh sizes, on the theory that concentrating tables, long on the market, were more appropriate machines than flotation cells for such relatively coarse feed, would eliminate the slime losses due to grinding, and give a lower phosphate loss in the quartz tailings. At the San Gully washer No. 1 of the Southern Phosphate Corp., a single standard size of concentrating table was installed in 1932 and the practice developed in this pilot operation has determined the design of this company's Standard washer at Medulla (early 1934), and also its new San Gully No. 2 washer (early 1937)[6] near Lakeland."

Tennessee Barite.—The Minerals Testing Laboratory of the Tennessee Valley Authority has made a series of experimental tests covering the beneficitation of barite found in the Valley area. Numerous deposits were sampled, but nearly all the material found contained a high percentage of iron and silica. Because of the small difference in specific gravity between the iron oxide and the barite a gravity separation is generally not satisfactory. Some of the operators have used magnetic separation to produce a product containing less than 1 per cent. iron. The experiments reported by members[7] of the T.V.A. staff were conducted to determine the application of decrepitation or flotation in simplifying the concentration of barite by removing both iron oxide and silica in one operation. Bleaching studies were also made to improve the color of the marketable product. The test showed that barite could be floated to a salable concentrate, although for one sample three cleanings were necessary to eliminate both the iron oxide and the silica. A simpler procedure, however, was satisfactory for some of the other ores of the Valley and it was thought that rougher treatment alone might be sufficient for certain ores that are just below a salable concentrate.

Other papers relating to milling practice dealt with filtration methods for industrial minerals, froth flotation of flourspar, and developments in drying, pulverizing, and air separating.

Pozzuolanic Materials.—Roy W. Carlson, professor of civil engineering at Massachusetts Institute of Technology, discussed the use of pozzuolanic materials in blended cements. He was enthusiastic over their use for massive structures such as dams, bridges, foundations and the like when a proper pozzuolanic blending material could be made available at a low cost. He mentioned low heat of hydration, higher silica content, and resistance to salt solutions as definite advantages. Among the disadvantages to be considered are greater shrinkage, slower hardening, and lack of uniformity of pozzuolanic cements. In addition to pumicite and other materials of volcanic origin, fly ash, slag, clay, and other siliceous materials have been used, according to Professor Carlson.

Safety in Cement Manufacture.—The remarkable safety record of the Portland-cement industry is well known, but it has not been accomplished without hard work. A. J. R. Curtis[8] of the Portland Cement Assn. prepared a paper outlining the safety program that has made the record possible. Unfortunately, Mr. Curtis was not present to present his paper which may be abstracted as follows:

"During the early part of the century, there began a complete transformation in the processes of manufacturing cement, but even before effective compensation laws had been passed in most states the Portland Cement Assn. had assigned to an Accident Prevention Committee the responsibility for guiding and directing the safety work of the entire industry. The committee set out at once to analyze the problem with which it had to deal. The members appointed an inspector to visit each plant, to determine what mechanical hazards existed and the necessary steps for their correction. Also, they took steps to secure from each plant a report of every lost-time injury.

"This reporting system has been the foundation of the association's entire accident-prevention program. Its value as an index of accident causes can not be overestimated. No one plant could possibly experience, even within a lifetime, all kinds of accidents and no one plant would ordinarily have all possible hazards, but the composite experience of more than 100 plants throughout the United States and Canada has given a clear conception of the industry's potential hazards. On this knowledge the preventive work has been based.

"For the first two or three years the available data were not adequate for the establishment of any dogmatic

[6] Trauffer, W. E.—*Washing Plant of Southern Phosphate Corp. Sets New Standard for Industry.* PIT AND QUARRY, Sept. 1937, pp. 41-48.

[7] Rankin, H. S., Laurence, R. A., Davis, F. A. W., Houston, E. C., and McMurray, L. L.—*Concentration Tests on Tennessee Valley Barite.* A.I.M.M.E. Tech. Pub. 880, 13 pp.

[8] Curtis, A. J. R.—*Organization for Safety in the Portland-Cement Assn.* A.I.M.M.E. Tech. Pub. 859, 18 pp.

principles. Pending the acquisition of enough information safety work centered around the safeguarding of plant machinery; but even after every mechanical safeguard within the ken of human ingenuity had been incorporated into machine design men continued to get hurt. It must be remembered, though, that the safeguarding of machinery was not a vain gesture. In addition to reducing accidents 15 per cent. the comprehensive installation of guards demonstrated to the workmen the sincerity of the company's interest.

"The belief was rapidly growing that human fallibility was a more important cause of injury than unguarded or inherently hazardous machinery. The aggregate of data for several years, compiled from members' accident reports, confirmed this belief and gave conclusive evidence of the need for careful employee education.

"In 1923 the first Portland Cement Assn. safety trophy was won by a plant that experienced only three lost-time injuries—a record that previously was unheard of. In fact, some of the disappointed losers were at first inclined to doubt its credibility. In 1924 a plant astonished everyone by completing the year without a single lost-time injury. Since then, an increasing number of plants have had 'no-lost-time injury years.' Now the trophy, instead of being won by a single plant each year, is given to every plant that completes a full calendar year without a lost-time injury. Additional 'no-lost-time injury' years are commemorated by an inscription on the base of the original trophy. In all, 117 plants have received at least one award."

In organizing a plant safety committee, according to Mr. Curtis, several points must be observed to attain greatest efficiency.

"1. The plant management—not only the superintendent but those in higher authority—must give wholehearted support to the committee.

"2. The foreman must be recognized as the 'key' man in the organization.

"3. The rank-and-file employees must have a definite responsibility in the program.

"4. The committee should be so organized that it will insure a well-planned and properly-executed safety program.

"In considering a safety program, it must be realized that its effectiveness depends not only on its intensity but also on its persistence. We have ample proof from the experience of other industrial organizations that any departure from the standard of all-inclusiveness or tendency toward loss of interest on the part of even a few persons will immediately have adverse results.

"A valuable and somewhat unexpected by-product of the program has been the stimulation of public goodwill. The June no-accident campaigns have become a matter of public interest in every cement community. The trophy awards have attracted favorable attention all over the continent. Many congratulatory messages have been received from high state officials. It must be emphasized, though, that publicity, welcome as it is, has been strictly a by-product. The sole aim has been to protect the employees of the cement industry from the unnecessary misfortunes of permanent disablement or death."

In the ensuing discussion Dan Harrington, chief of the Health and Safety Branch, U. S. Bureau of Mines, paid a fine tribute to Mr. Curtis, the Portland Cement Assn., and the industry as a whole on their splendid accomplishment of maintaining such a remarkable safety record.

Rostone. — The manufacture of Rostone is of particular interest to stone producers because it affords a potential outlet for quarry waste. It was first developed in Lafayette, Ind., where its manufacture and use are now definitely established. The plant at Lafayette grinds waste Indiana limestone so that most of it passes the 325-mesh screen. It is then dry-mixed with lime and a specific quantity of water is added. This mixture is then pressed to the desired shape and the resultant products are cured in an autoclave. After 6 hrs. under steam pressure the product is ready for immediate use, no further curing being required. This approximately 24-hr. period of manufacture is in contrast to the 28-day period necessary for the natural curing of cast stone and similar concrete products.

Rostone can be produced by using the waste of any common quarry rocks and the product can be made in virtually any color through the use of nonfading mineral pigments. It has recently been produced in small molded shapes comparable to the organic plastics now commonly used.

A product similar to Rostone is now being manufactured in Detroit with fly ash as the principal constituent. This material is used principally in the form of building units similar to ordinary cinder-concrete blocks. Definite advantages in weight reduction and good insulating properties are claimed for this product.

Ground Mica.—Paul M. Tyler[9] of the Bureau of Mines summarized technologic advance and the economic aspects of the ground-mica industry. He commented particularly on the increasingly-large quantities of ground mica recovered as a by-product from clay washing, as a joint product with kyanite, and by grinding schists. After tracing the financial hazards involved in mining mica and describing the grinding processes, Mr. Tyler discussed the uses as follows:

"Striking features of ground-mica statistics are the rapid growth in the consumption of roofing mica and the marked decline in the sales to the rubber industry. Less striking, but seemingly most significant of all, is the sudden emergence of paint as a major outlet. Prior to 1936 relatively-small amounts of mica were used by paint manufacturers, chiefly in fancy paints, but in that year they jumped to 1,307 tons valued at $71,155. This does not stand out as really big business yet and it represents only 6 per cent. of the total sales of ground mica, but inquiries in the trade and rumblings from the laboratories indicate that so far it is only a straw in the wind. Sound reasons exist for employing large quantities of mica in almost any kind of paint. In addition to embodying the functions of lubricant and extender, the transparent mica flakes serve to bond the film, prevent it from cracking, and improve adherence in much the same way as do the leaflike metal particles in aluminum and, more recently, metallic-lead paints.

"At present more than three-fourths of all ground-mica sales are for roll roofing, a distinctly American product. In addition to the sales of 'roofing' mica considerable ground mica is also used in asphalt shingles. Roofing mica is almost wholly dry-ground, although small quantities of slightly off-color wet-ground mica from by-product sources may find an outlet in the roofing field. Mica is particularly well suited to this purpose because of its high covering power, the fact that it is not absorbed by the freshly-impregnated paper, and because it resists attack by acid in the asphalt and by weathering. Specifications vary, but most roofing mica is moderately coarse; formerly it was often as coarse as 5-mesh but usually now it passes 20-mesh and may or may not contain sizes finer than 100-mesh. The chief function of the mica is to prevent the surfaces of the roofing from sticking together in the roll.

[9] Tyler, P. M.—*Technology and Economics of Ground Mica.* A.I.M.M.E. Tech. Pub. 889, 17 pp.

Talc, slate, and various types of granules serve much the same purpose and hence limit the price that roofing manufacturers will pay for mica.

"Sales to wall-paper manufacturers recently have shown a healthy increase, reflecting recovery in that industry as well as some increase in the popularity of the silvery sheen effects produced by wet-ground mica additions to the printing inks. Wall-paper mica is virtually all through 100-mesh and 75 to 90 per cent. through 325-mesh. The rubber industry, which apparently uses only wet-ground mica, employs a little mica as an ingredient of special insulation, but mostly to coat the water bags and as a general mold lubricant to prevent the rubber from sticking while it is being formed and vulcanized. Other lubricants, such as talc, and pyrophyllite, are cheaper and apparently have been substituted to a considerable extent for the manufacture of automobile tires.

"In 1936 miscellaneous uses, such as molded electrical insulation, asbestos insulation, surfacing asphalt shingles, Christmas-tree snow, axle grease and other lubricants, annealing steel, foundry facing, boiler compositions, surfacing concrete and cast stone, pipe-line enamel and plastic specialties used 614 tons of mica. Increasing quantities are used in plastic wall finishes, the finely-ground mica acting as a lubricant and rendering them especially receptive to textural effects. Best known, perhaps, is the relatively-small use for ornamental purposes, particularly snowlike effects for Christmas-tree decoration and in motion-picture studios, which take dry-ground mica in coarse flakes, 4- to 10-mesh. 'Micalex' is an important type of electrical insulation, made by melting (about 675 deg. C.) one part of lead borate or soft glass with about two parts of 60-mesh mica; it can not compete with sheet mica or mica board but it has better electrical and mechanical properties than porcelain and certain other substances and is used for antenna insulators, brush holders, and insulated-pipe joints. As a heat insulator ground mica has additional possibilities, though in this respect vermiculite is even better and much cheaper. Whereas ground mica, bagged, rarely bulks as little as 14 lb. per cu. ft., more often 16 to 18, a cu. ft. of properly expanded vermiculite weighs only 5 to 7 lb. It is probable that vermiculite will compete with ground mica in the paint industry, too, although for this and other important outlets mica has the advantage as regards color or transparency."

Advances in Technology and Uses.—The summary of advances in technology and uses of industrial minerals by Oliver Bowles[10] of the Bureau of Mines has become one of the outstanding features of the program of the Industrial Minerals Division. Dr. Bowles covers the entire field of nonmetals and many of the items given only passing mention in his review might well be amplified into separate papers. In fact several of the papers appearing on the programs of the Industrial Minerals Division in the past two or three years cover subjects first referred to in one of his reviews. The high lights of Dr. Bowles' contribution may be abstracted as follows:

"*Beneficiation.*—Concentration and purification methods long known in metallic-ore dressing are being used to an ever-greater extent in preparing industrial minerals. Froth flotation is now applied commercially to cement raw materials, phosphate, fluorspar, clay, talc, halite, and sylvite. There are records of about thirty minerals (mostly of basic nature) that are separable by the the so-called anion or soapy wetting agents. The Bureau of Mines is now engaged in developing processes for separating silicate minerals by the use of cationic filming agents (those applicable to acidic minerals).

"Significant, too, is the rapid improvement in dry methods of concentration — dry tabling, magnetic and electrostatic treatment, and the more mysterious processes involving pyroëlectric or simply frictional electrical effects. Certain of these special methods work where no basis exists for gravity separation and where even froth flotation and the allied art of oiling and tabling have so far failed to accomplish the desired results. A new electrostatic separator equipped with a grounded rotor and a gas-filled electrode is capable of making noteworthy mineral separations. Like the older forms of wet concentration, most of these dry methods are not ordinarily applicable to sizes smaller than about 100-mesh, but hope has been renewed that even this handicap may eventually be overcome. However, the cleaning of particles smaller than 325-mesh still promises to impose tremendous difficulties by either wet or dry methods and remains an important objective for research. This particularly applies in the field of industrial minerals so many of which have to be finely pulverized and carefully freed from certain objectionable impurities to prepare them for market.

"*Aggregates.*—Further changes are being made in the specifications for aggregates. The A. S. T. M. has prepared a tentative specification for a method of test for abrasion of coarse aggregate by the Los Angeles machine, now generally regarded with favor. The method of test for soundness by use of sodium sulphate or magnesium sulphate has been further revised and a specification for lightweight aggregate has been proposed. Stone sand, used quite extensively, is now prepared in sizes ranging from $\frac{1}{8}$- to $\frac{3}{16}$-in. rather than $\frac{3}{8}$-in. and with finer materials. The finer sand promotes better workability of concrete. A new type of moisture-proof detonating fuse has been introduced for deep-hole blasting, and wider use of high-ammonia dynamites and semi-gelatins has been noted. These newer developments tend to promote safety in blasting.

"*Cement.*—An outstanding development in cement technology is the general recognition that sieve residues are poor indicators of fineness. Reactions that occur during the setting and hardening of cement begin at the grain surface and the speed and intensity of the reactions bear a definite relationship to the area exposed. Therefore, fineness is now measured by the surface area of the particles in a given weight of the material, for example, square centimeters per gram. In new A. S. T. M. specifications fineness measurements are based on this new technique rather than on screen analysis. The profound effect of particle size on the properties and reactions of cement has led to many changes and refinements in grinding. The high efficiency of closed-circuit grinding in conjunction with air-separation is more generally recognized and the method is attaining wider use.

"Because of continued research and more exacting demands of consumers, many changes are being made in cement specifications. The A. S. T. M. has modified the specifications for standard Portland cement, natural cement, and the method of analysis, and has issued a proposed specification for blended cements. The latter are defined as those containing one or more admixtures other than materials used to regulate the set. The tentative specifications for high-early-strength Portland cement have been adopted as standard. The Federal Specifications Executive Committee has also compiled specifications covering: (1) normal Portland cement; (2) rapid-hardening Portland cement; (3) moderate-heat Portland cement; and (4) sulphate-resisting cement.

"Cement manufacture is undergoing a remarkable renovation. The incentives behind the improvements are: (1) a growing demand for high-

[10] Bowles, Oliver.—*Industrial Minerals; Outstanding Advances in Technology and Uses.* Mining and Metallurgy, January 1938, pp. 56-61.

early-strength and other special cements; (2) the need for lower productions costs to meet those of the more efficient competitive mills; (3) obsolescence that quickly overtakes plants because of numerous and radical improvements in equipment and methods; and (4) more exacting specifications.

"*Gypsum.*—A new hydraulic gypsum cement (U. S. Patent No. 2090625 dated August 24, 1937) offers possibilities of great interest in the construction field. It is claimed that gypsum or anhydrite intimately mixed with phosphoric acid and sodium phosphate in an amount not exceeding 2 per cent. by weight, and silica or silicate not exceeding 3 per cent. by weight, when calcined at temperatures ranging from 1,800 deg. to 2,300 deg. F. will give a hydraulic cement that will resist the weather as well as Portland cement, will have working qualities equal to Keene's cement, and will develop strengths both compressive and in tension far in excess of those possessed by gypsum cements made heretofore. The material acquires an initial set in less than 90 min., has a water-cement ratio of 24 to 27 c.c., and develops a strength in tension after 7 days of more than 600 lb. per sq. in. Laboratory studies have been followed by pilot-plant production.

"It is now possible to calcine and pulverize gypsum in one operation eliminating the ordinary kettles. Plaster of Paris is thus produced at low cost, but the product is not suitable for all uses. Until recently the United States has produced no alabaster, but small quantities are now quarried in Larimer County, Colo., and made into various novelties.

"*Lime.*—Progress is to be recorded in the recovery of carbon dioxide at lime plants. In the United States efforts have been directed toward methods of calcination whereby the carbon dioxide from the limestone is not contaminated with the impure fuel gases. This is the principle of the Gillette process. The Mount Frome Lime Co. plant at St. Peters, New South Wales, Australia, employs a different process. The kiln gases, which are quite impure, are passed through absorption towers, where they come in contact with a solution of potassium carbonate, with which the carbon dioxide unites to form potassium bicarbonate. When the latter is heated to 80 deg. C. it decomposes and sets the gas free and the potassium carbonate is returned for another cycle. Both liquid and solid carbon dioxide are made as by-products at this lime plant.

"*Mineral Wool.*—The Kansas Geological Survey has issued a report on *Rock Wool Resources of Kansas,* and the Oklahoma Geological Survey is studying suitable materials for mineral-wool manufacture occurring in that state. A new and interesting use of glass wool discovered by R. C. Allen, of the Cornell department of floriculture and ornamental horticulture, Ithaca, N. Y., is the previously-mentioned application of glass-wool blankets for winter protection of delicate plants. This new form of mulch is said to be much more effective than straw, leaves, pine needles or excelsior and permits penetration of enough light to keep foliage green.

"*Phosphate.*—The Department of Agriculture and the Tennessee Valley Authority have emphasized the advantages of phosphate smelting for production of elemental phosphorus, a product so concentrated that it may be shipped long distances. The process is evidently attaining commercial importance, for the Phosphate Mining Co. has begun the production of elemental phosphorus with its new electric furnace at Nichols, Fla.; and the Monsanto company, of St. Louis, has recently completed a large plant near Columbia, Maury County, Tenn., that will use relatively low-grade phosphate rock for the manufacture of elemental phosphorus. Steps were taken during 1937 to promote a national program for the development and utilization of the phosphate resources in Wyoming, Utah, Montana, and Idaho. Both Federal and state agencies are coöperating in this movement.

"*Nepheline.*—Increased production of nepheline syenite in Methuen township, Ontario, is reported. The original small mill at Lakefield, having a capacity of 25 or 30 tons of finished product per day, has been enlarged by the addition of another set of rolls and further magnetic-separation equipment. During 1937 the American Nepheline Corp., of Rochester, N. Y., a subsidiary of the Canadian company, was organized to construct and operate a grinding plant at Rochester, using rock from the Ontario quarry. The mill, which began operation in November, 1937, has a capacity of 250 tons of crude material a day. The expected recovery is about 70 per cent., giving approximately 175 tons a day of finished product.

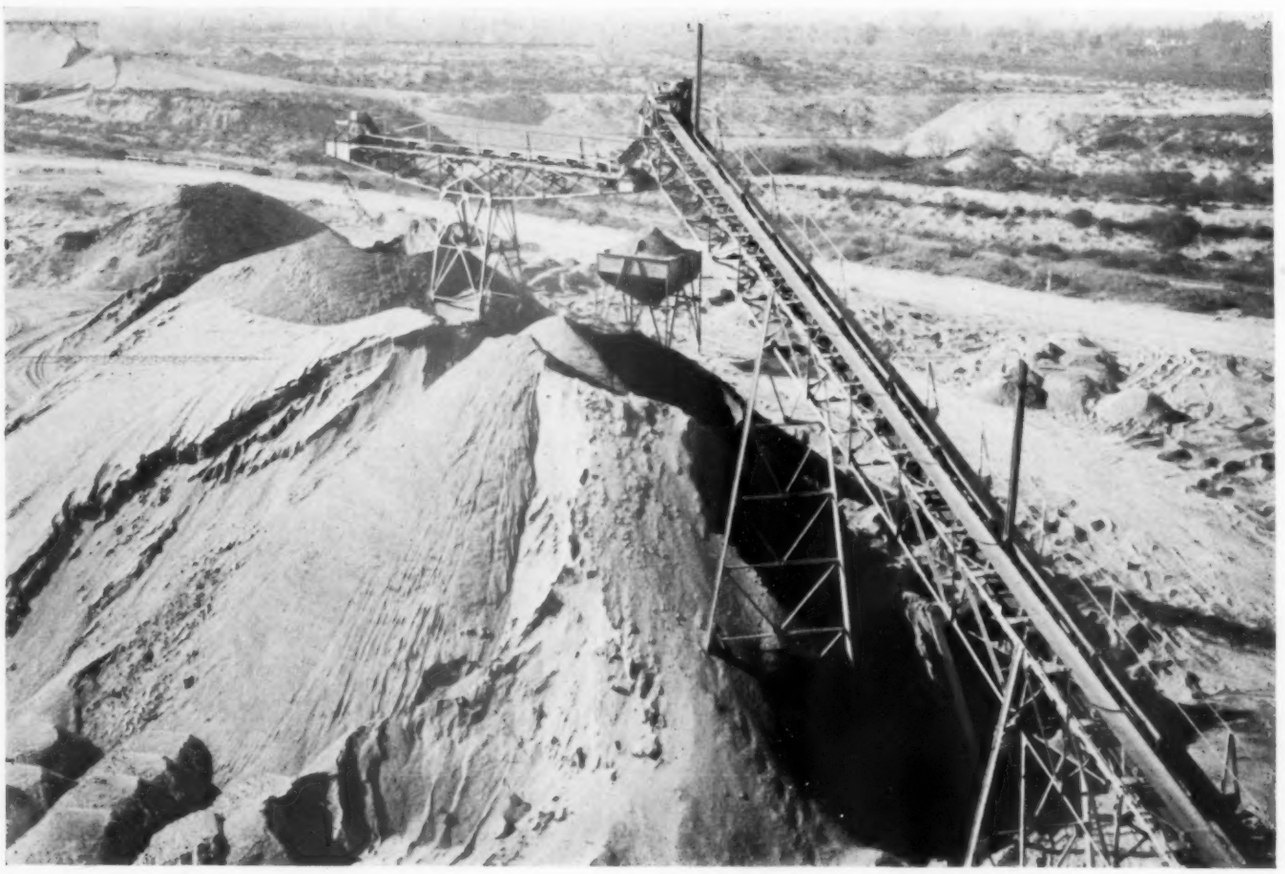
"*Feldspar.* — Notwithstanding increasing importations of Canadian nepheline syenite for glassmaking, the sales of feldspar have been running ahead of 1936, itself an all-time record year. To promote a wider use of feldspar on a scientific basis, much research has been conducted, especially toward the use of feldspar in glass, floor and wall tile, and in various porcelains. The results of comprehensive technical investigations of the effects of feldspar on glasses of various kinds have been published by the National Feldspar Assn. Methods have been perfected for a more accurate analysis of feldspar. The use of feldspar as a binder in abrasive wheels has long been known but, recently, it is finding use as a binder in refractories also."

Thoenen Elected Chairman.—The new chairman of the Industrial Minerals Division, J. R. Thoenen, is well known in the institute and throughout the mining industry. He has served as secretary of the division since its creation three years ago and has been active in institute affairs since 1915. Mr. Thoenen is head of the nonmetals section of the Mining Division of the U. S. Bureau of Mines with headquarters at College Park, Md. His work relating to production problems of crushed stone and sand and gravel has been given wide publicity and more recently his application of geophysical methods for measuring vibration resulting from quarry blasts has received favorable attention.

Bibliography.—All the papers included in the program of the Industrial Minerals Division have not been printed but those available for distribution are included in the following list. The numbers refer to text references. Other institute papers referred to in the text are not available at present, but it is expected that some of them may be printed later. Members of the Institute may procure copies of all printed reports free and nonmembers at a small charge by writing to The Secretary, A.I.M.M.E., 29 West 39th Street, New York, N. Y.

The operation of this Lima electric shovel in a limestone mine with an 11-ft. ceiling was made possible by a Westinghouse gear-motor which powers its motions, including the driving of the boom. It is said to be able to shovel limestone nearly a third faster than a compressed-air shovel.

A Flexible California Gravel Plant



The unwashed dry-sand stock-piling system at the John D. Gregg plant with tunnel underneath for truck loading.

ONE of the more important of the "independent" sand-and-gravel producers in the Los Angeles area is John D. Gregg of Whittier, Cal., who operates plants at Roscoe and Monrovia, all suburbs of that city. The Roscoe plant, larger of the two, is located in the Tujunga Wash in the San Fernando Valley about 16 mi. northwest of downtown Los Angeles. This wash or dry river bed supplies much of the sand and gravel used in this area.

The Roscoe plant presents an interesting study of improvement and expansion and the changing of methods to meet new conditions. When built in 1932, this plant had a capacity of 60 tons per hr. A 1½-cu. yd. drag-scraper was used to open the deposit. A bucket-elevator fed a revolving screen which did all the gravel sizing, and sand was graded by a sand-drag.

In 1935 improvements which doubled the capacity of this plant and provided for separate processing of gravel and crushed gravel were completed. The original drag-scraper was replaced with one of 3-cu. yd. capacity with a larger hoist. A hopper, a primary crusher and a grizzly were installed in the pit with a 300-ft. belt-conveyor feeding the revolving screen which was converted into a scalper. This screen removed the dry sand and discharged it on a conveyor running to the stock-piling system. Two gyratory crushers were installed to crush the coarser sizes of gravel coming from this screen and these were fed on a 4-ft. by 8-ft. double-deck vibrating screen which took the place of the revolving screen. A new concrete bin structure was erected and three new vibrating screens and the original sand-drags were installed to process the sand and gravel.

The latest series of improvements completed early in 1937 further increased the capacity of this plant. The scraper system was abandoned and a new 1½-cu. yd. electric shovel, a hopper and a pit conveyor were installed to feed the existing crusher and conveyor running to the scalping screen. A 4-ft. by 12-ft. triple-deck vibrating screen replaced the smaller screen in the crushed-gravel department and a special unit was installed to produce extremely fine sand.

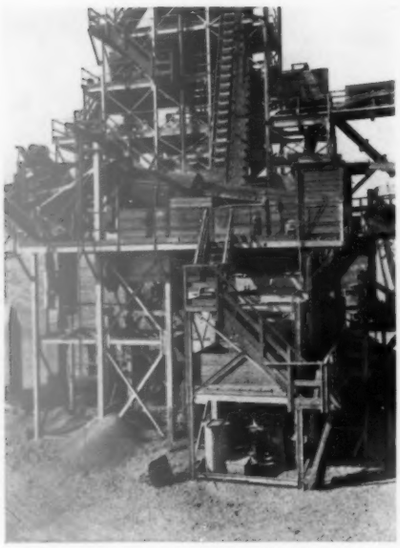
This plant can now produce from 200 to 250 tons per hr., depending on the types and sizes of material in demand. Usually the products consist of 30 per cent. sand, 35 per cent. gravel and 35 per cent. crushed gravel, or rock as it is known on the Pacific Coast. No railway shipments are made from the plant.

This plant, or to be accurate, these two plants, make possible great flexibility in sizes and types of products. Production can be concentrated on a wide variety of sizes of either crushed or uncrushed gravel, or on a few sizes as desired. The expensive stock-piling of excess material of different sizes is not a problem here. Another feature

By W. E. TRAUFFER

The new 1½-cu. yd. electric shovel cleaning up in the pit preparatory to moving the hopper to another position.

The 1½-cu. yd. shovel moving the pit hopper to a new location.



The scalping screen and reduction crushers with new screening building in background.

The new classifier used to produce an extremely fine plaster sand from the regular sand-drag overflow. Flume from plant at right.

The plant with crushed-gravel building at left and new washed-gravel building at right. The new office building is at extreme left.

BELOW—The primary crusher with truck hopper and plant in background.

is the removal of dry unwashed sand at the scalping screen, when it is in demand.

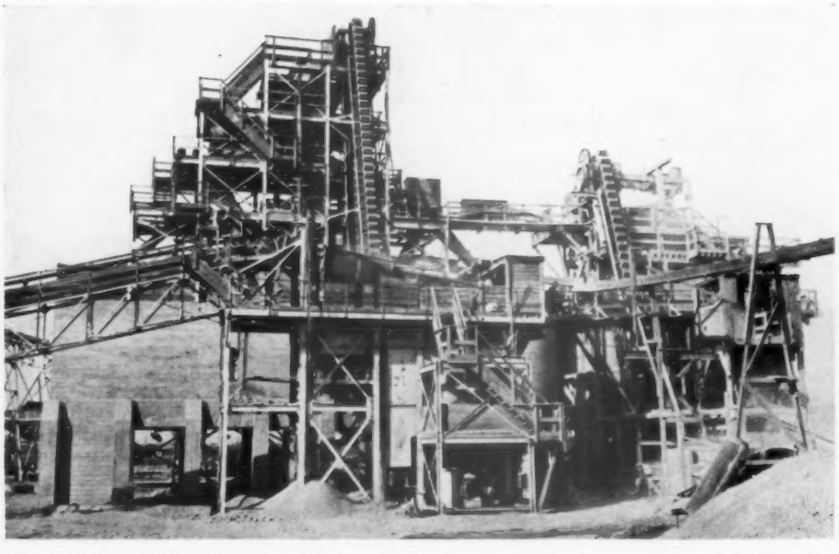
The pit has been dug to about 100 ft. below ground level and is being extended at that level by the use of field conveyors. The deposit, like all others in this section, is stratified with each stratum varying in the percentage and size of sand and gravel. On an average the material now being caved down contains about 30 per cent. sand and some bowlders. The latter occur mainly at the present pit level. The bowlders over 12 in. in size which are wasted form about 5 per cent. of the material. The small amount of overburden is not removed.

The Lima No. 850 electric crawler shovel with its 1½-cu. yd. dipper is a special job combining the features of the No. 801 and 901 shovels made by this company. It has a 35-ft. boom and a 24-ft. dipper stick, both extra long, which make it possible for this machine to scratch a 45-ft. bank. This shovel feeds a special 25-ton hopper which was designed and built by the Conveyor Co. and has a 12-in. clear flat grizzly to reject boulders too large to be crushed. This hopper comprises a vertical, cylindrical steel shell that supports an inverted, conical, funnel-type mouth through which the material falls into the square hopper below it and inside the shell. A special reciprocating feeder discharges the material on a chute to the field belt-conveyor. A number of parallel steel rails bent at their centers are suspended over the chute in such a way that their weight evens out the flow of material to the belt and prevents the large bowlders from falling on it hard enough to do damage or cause excessive belt wear.

The 1½-cu. yd. electric shovel loading the pit hopper just before it was moved to a new location.

The feeder is a double reciprocating machine with the two 18-in. feeder plates actuated by separate eccentrics opposed at 180 deg. on the same drive shaft. SKF self-aligning bearings are used and the feeder is driven through a chain from the tail pulley of the field conveyor. The use of two reciprocating plates results in a more even feed than is possible with only one.

The writer was fortunate enough to be present at this plant when the field conveyor was being extended to a length of 85 ft. and the hopper moved to a new location. As shown in one of the accompanying photographs, the grizzly and the top of the hopper are first taken off and the main section is moved into its new position. The other two sections are then put back in place. All this work is done by the shovel.



Another view of the plant with the new washed gravel screening building at the left. The scalping-and-crushing equipment is in the foreground.

The 36-in. by 85-ft. field belt-conveyor is mounted on a sectional framework made up of steel plates and channels supported by welded angle-iron legs. The material is discharged from this conveyor through a junction box on the 36-in. by 400-ft. inclined pit conveyor. Swinging rails in this box regulate the flow of the material. The troughing rolls on both these conveyors have New Departure ball-bearings which are lubricated for life.

Material is discharged from the pit conveyor on a 5-in. clear sloping grizzly from which the oversize rock drops into the 14-in. by 24-in. Alloy Steel & Metals Co. primary jaw crusher. The minus 3-in. product of this crusher and the material passing through the grizzly drop on the 24-in. by 300-ft. inclined belt-conveyor running to the plant. The material is discharged from this conveyor into the 40-in. by 20-ft. Allis-Chalmers revolving scalping screen. Perforated plate with 1½-in. round openings is used on the main barrel of this screen and wire cloth with 3/32-in. by ¾-in. openings on the 8-ft. sand jacket. The gravel retained on the main barrel of this screen goes to the crushed-gravel plant which will be described later.

The dry sand can be discharged on a 16-in. by 60-ft. belt-conveyor which passes horizontally through a concrete tunnel in the new storage bins to the unwashed sand stock-piling system. When dry sand is not needed, the sand can be discharged from this screen with the gravel for further processing in the plant.

Either dry, unwashed plaster sand or concrete sand can be made by changing the cloth on the sand jacket of the scalping screen. The unwashed plaster sand will pass specifications and is pre-

The plant and conveyor system viewed from the far side of the pit. At the left is the unwashed sand stock-piling system.

ferred by many plasterers to washed sand because it is more workable and gives a better finish. The same is true to some extent of the dry concrete sand, but as Los Angeles city specifications allow a maximum of only 5 per cent. through 100-mesh not much of it is produced. As the dry, unwashed plaster sand can be produced only in dry weather, enough is stored before the winter rains begin to supply the demand for several months.

The unwashed sand is discharged from the above-mentioned conveyor on a 16-in. by 150-ft. inclined belt-conveyor. The dry concrete sand is discharged from the end of this belt on a stock-pile. When dry plaster sand is produced, it is discharged from this conveyor through a chute on a 16-in. by 40-ft. horizontal belt-conveyor from which it is discharged on a stock-pile. Both stock-piles are over a concrete tunnel whose roof has six gates through which trucks in the tunnel are loaded. Each stock-pile has a live storage capacity of about 300 tons. In order to keep the stock-piles as free from obstruction as possible, both the stock-piling conveyors are supported in a manner not often found in aggregates plants. The structural-steel truss framework supporting the inclined conveyor is of cantilever design with the last steel support and its concrete foundation almost clear of the stock-pile. The horizontal stock-piling conveyor is of double-cantilever design and is supported at the center on a single steel frame resting on the concrete tunnel.

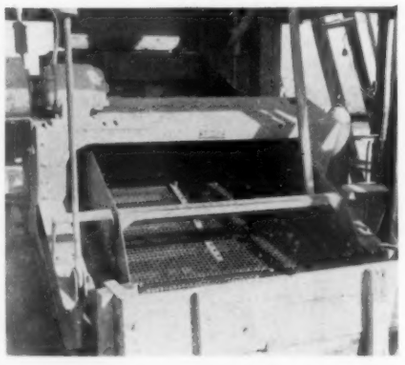
All the material passing through the main barrel of the scalping screen goes through a chute to a 16- in. by 70-ft. belt-bucket elevator which discharges it on the first of the three vibrating screens in the new section of the plant. This is a Conveyor Co. 4-ft by 8-ft. double-deck screen with ¾-in. and 7/32-in. openings. The sand passing through the bottom deck goes to the sand-drags. The gravel retained on the top deck goes to a 4-ft. by 8-ft. double-deck screen, and that retained on the bottom deck goes to a 4-ft. by 8-ft. triple-deck screen, both made by the Conveyor Co.

The second double-deck screen has 1½-in. and 1 1/16-in. openings. The material retained on its top deck is discharged into a hopper feeding the No. 7 Allis-Chalmers Newhouse crusher. The materials retained on and passing through the bottom deck are discharged into separate bins.

The triple-deck screen has ½-in., 5/16-in. and 7/32-in. openings. The material retained on the top deck is discharged into the same bin as that passing through the bottom deck of the second double-deck screen. The material retained on the center deck can also be discharged into this bin or into a separate bin as large pea gravel. The material retained on the bottom deck goes into another bin as small pea gravel and that passing through the bottom deck goes to the sand-drags. All these three screens have spray pipes for washing and provisions for adding water at their feed boxes, but those on the second double-deck screen are used only when necessary.

The sand is split to the two Conveyor Co. drag-washers, one of which is 30-in. wide and the other 18-in. These drags are operated as a pair with both producing either concrete sand or plaster sand simultaneously. These products are discharged into bins. The bin structure supporting this equipment is made of reinforced concrete and has five compartments of 60-ton capacity each. Trucks are loaded under the bins through drop-chute gates. Concrete sand can also be stored in a 70-ton capacity steel tank.

The overflow from the sand-drags was formerly wasted but is now flumed to a Conveycone classifier, which reclaims the extremely fine sand. This is the first installation of this machine, which is made by the Conveyor Co.



One of the three vibrating screens installed in the new section of the plant.

A small revolving screen first removes trash from the material fed to the Conveycone. Below the screen is a 12-ft.-square hopper-bottom settling tank within which is a 4ft.-diameter tank, supported rigidly from the outer tank. The circular tank has a conical bottom with a saw-tooth bottom open-

ing. A large float inside it is connected by a lever with a ball, which closes the discharge opening in the large tank. When the level of silt in the large tank gets too high, the mounting water level in the small cone raises the float and lowers the ball to speed up the discharge. The reverse happens when the silt level becomes too low. The product of this classifier is discharged into a stock-pile by means of a 12-in. by 24-ft. screw-conveyor, which is necessary in this installation only because the classifier is at ground level instead of up in the plant.

The product of this classifier contains as high as 10 per cent. material passing 100-mesh with a maximum of 10-mesh. This product consists of about 65 per cent. solids and is produced at the rate of about 10 tons per hr. Most of it is sold as specially-fine

The two gyratory crushers under the scalping screen with feed boxes above.

plaster sand. The overflow from this classifier goes to a waste pond.

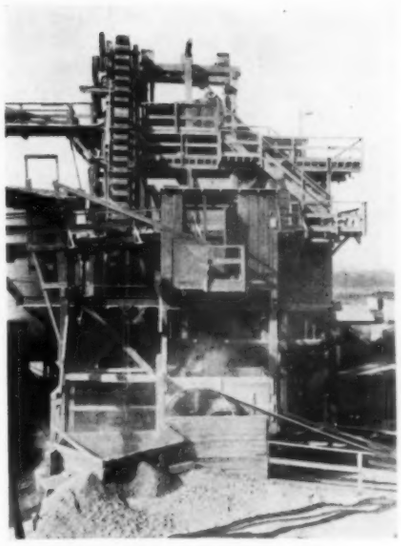
The gravel retained on the main barrel of the scalping screen is discharged along with the oversize from one of the uncrushed-gravel screens into a steel surge hopper feeding a No. 7 Allis-Chalmers Newhouse crusher. The minus 1½-in. crusher product is discharged on a 24-in. by 26-ft. belt-conveyor which supplies an 18-in. by 50-ft. belt-bucket elevator. All the sizing of the crushed gravel is done by a 4-ft. by 12-ft. Allis-Chalmers triple-deck Low-Head screen. Ordinarily 1½-in. cloth is used on its top deck and 7-ft. of 5/16-in. and 5 ft. of 1 1/16-in. cloth on its middle deck. On the bottom deck 6 ft. of 1/10-in. cloth is followed by 4 ft. of ¾-in. cloth with a discharge gap between them. With this arrangement six sizes of material including dust are made.

Usually the material over 1½-in. in size is discharged on a 16-in. by 65-ft. belt-conveyor feeding the steel surge box of a No. 5 Newhouse crusher for further reduction. The product of this crusher is discharged on the same belt-conveyor as the product of the No. 7 crusher. The material retained on the 1 1/16-in. section of this Low-Head screen is usually discharged into a 16-in. by 36-in. Allis-Chalmers double-roll crusher, whose product is discharged to the rock elevator already described. Under this arrangement the screen is now sizing 150 tons of material per hr., including the circulating load from these two crushers. Some of the smaller sizes produced by this screen can also be passed through the No. 5 Newhouse crusher or the roll crusher, if desired. Any desired sizes of crushed gravel can be made by varying the sizes of the screen cloth and changing the crusher openings. The screen products not crushed are discharged direct into storage bins. The wooden storage unit has five compartments, each of 60-ton capacity. Trucks are loaded under the bins.

If desired, some of the coarser sizes of gravel can also be discharged from the scalping screen into the No. 7 Newhouse crusher. The No. 5 Newhouse crusher can also be used to crush all or any part of this material, which can also be split to feed both crushers, if desired.

Economical washing of the aggregates is made possible by the re-use of the water from the waste pond. A centrifugal pump driven by a 50-hp. motor is used to recirculate this water through the plant. Additional water to replenish the supply is obtained from the city mains.

The company has a Northwest gasoline crawler crane with a ¾-cu. yd. clam-shell bucket, which is used to build up the stock-piles. This machine and a Northwest ½-cu. yd. crawler shovel are used to load trucks from the stock-piles. A wooden truck ramp and bin over the conveyor from the primary crusher to the plant can be used when it is desired to recrush and



The crushed-gravel building with the new screen. The double-roll crusher is below.

process large sizes of gravel from the stock-piles.

The office building near the plant was built in 1936 and has heating and air-conditioning equipment. In it is the Fairbanks 24-ton truck scale on which all shipments are weighed. This scale has a 28-ft. platform which is long enough to weigh the tractor-trailer units used for delivery. Two Esterline-Angus kilowatt recorders in the office keep records of the power load, starts, stops, etc., and also give instant notice of any deviation from the normal load. One recorder is connected to the pit-conveyor power-line and the other to the main-plant power-line.

The improvements made to this plant were designed by the company's staff in coöperation with the Conveyor Co., which manufactured much of the equipment used. This company also supplied the field hopper and feed-

Another view of the plant with dry-sand stock-piling system at right and new office building at left.

er, the three gravel screens, the two sand-drags, the fine sand tank, the belt-conveyors, the drive chains, and other equipment. The Allis-Chalmers Mfg. Co. supplied the scalping screen, the two Newhouse crushers, the crushed-gravel screen, the double-roll reduction crusher and several Texrope drives. Most of the conveyor belting is Goodyear but some Goodrich belting is also used. Dodge V-belts are used almost exclusively. Sterling motors drive most of the equipment and all the motor-reducers are of this make. The Abbey Scherer Co. supplied all the wire screen cloth.

EQUIPMENT MOTORS AND DRIVES

Pit to Plant

Field hopper feeder—Chain from field conveyor.

Field conveyor—15-hp.—V-belts and gear.

Pit conveyor—50-hp.—V-belts and gear.

Primary jaw crusher—50-hp.—flat belt.

Plant conveyor—30-hp.—V-belts and gear.

Scalping screen—10-hp.—V-belts and gear.

Dry Unwashed Sand

Dry-sand conveyor—3-hp.—motor-reducer and chain.

Conveyor to stock-pile—5-hp.—motor-reducer and chain.

Horizontal stock-piling conveyor—3-hp.—motor-reducer and chain.

Sand and Gravel

Gravel elevator—20-hp.—V-belts and gear.

3 Vibrating screens—each 3-hp.—V-belts.

2 Sand-drag washers—same 10-hp.—flat belts.

Fine-sand screw-conveyor—5-hp.—motor-reducer and chain.

Centrifugal water pump—50-hp.—direct.

Crushed Gravel

7-in. Gyratory crusher—60-hp.—direct.

Belt-Conveyor—3-hp.—motor-reducer and chain.

Rock elevator—20-hp.—V-belts and gear.

Vibrating screen—7½-hp.—V-belts.

Belt-Conveyor—3-hp.—motor-reducer and chain.

5-in. Gyratory crusher—40-hp.—direct.

Double-roll reduction crusher—20-hp. and 10-hp.—flat belts.

Phosphate

(from page 41)

Agricultural Corporation is of all-steel construction. The slurry from the mining pit passes first through 4-ft. by 12-ft. trommel screens, where the mud balls and trash larger than 1⅛ in. in diameter is sent to waste. The trommel undersize goes to slotted flat screens, where part of the minus 14-mesh material and part of the water is eliminated. The flat screen oversize goes to a double-deck vibrating screen. The top screen is of ⅜-in. mesh, the oversize from which goes to a series of two Georgia Iron Works log washers. The minus ⅜-plus 14-mesh material goes to a Dorr 8-ft. Duplex classifier. The discharge from the second log washer and the rake discharge from the Dorr Duplex classifier is elevated by bucket elevators and passed over a series of two vibrating screens equipped with 14-mesh cloth.

The 3-in. pump under a rod-mill in the No. 2 concentrator.

All washer screen undersize is either delivered by gravity or pumped to a Dorr 40-ft. Hydroseparator. The Hydroseparator overflow goes to waste at this point, and the Hydroseparator discharge furnishes feed for the No. 2 flotation plant.

The washer is operated in two units, each unit consisting of one trommel screen, one double-deck vibrating screen, two log washers, and one 8-ft. Dorr classifier, followed by a series of two vibrating screens, most of which are Tyler Hum-mers.

The washed phosphate is pumped by an 8-in. Allen-Sherman-Hoff pump a distance of 3,600 ft. to the No. 2 concentrator.

At Plant No. 2 the minus 14-mesh washer waste is discharged into a Georgia Iron Works 4-ft. by 12-ft. trommel with ¼-in. openings. The tramp oversize flows to waste and the material passing through the screen is discharged into four 22-ft.-diameter feed bins. The overflow from these bins also goes to waste. Two of these bins feed a 4-ft. by 10-ft. Allis-Chalmers rod-mill. A 3-in. Wilfley pump transfers the mill product into a 20-ft.-diameter Dorr classifier. The other two bins feed a 5-ft. by 10-ft. Allis-Chalmers rod-mill from which a pump feeds another 20-ft.-diameter Dorr bowl classifier. The overflow from both bowl classifiers goes to waste by gravity.

The product of the first-mentioned bowl classifier is discharged into a rake classifier. The rake product is discharged into a rotary conditioner or mixer, where the reagents are added. This machine is a rotating cylinder which is set at a slight slope and is equipped with interior baffles. The material then goes to an elevator, which feeds the first machines in two rows or series of six cascade rougher cells each. Dilution water is added at the elevator discharge. The product of the other bowl classifier is discharged into a rake classifier. The rake product is discharged into a new-type 4-cell agitator, where the reagents are added. An elevator feeds this material to the first of two more series of six cascade rougher cells each alongside the first-mentioned series. The tailings from all these roughers is pumped to waste by a 10-in. Georgia Iron Works centrifugal pump.

The concentrate from the first-mentioned series of roughers goes to 4-cell, 24-in. MS sub-aëration cleaners from which the tailings are returned by a 3-in. Wilfley pump to the first rougher. The concentrate from the other series of roughers also goes to 4-cell, 24-in., MS Sub-A cleaners from which a 4-in. Wilfley pump returns the tailings to the first rougher cell in this series.

The concentrates from each of these cleaners are discharged into separate dewatering drags. Both drags are served by the same bucket-elevator, which discharges the dewatered concentrate into two 22-ft. filter bins. Cars are loaded under these bins to haul the concentrate to the drying plant.

Any one of the four 22-ft. feed bins can also serve the following flow. The material first goes to a 4-ft. Dorr Simplex classifier followed by a rake classifier. The overflow goes to either of the two 20-ft. bowl classifiers already mentioned. The rake product is carried on an 18-in. belt-conveyor to a rotary mixer in which the reagents are added. The mixture is then fed to four No. 6 Wilfley concentrating tables. The tailings from these tables go to waste and the concentrates are discharged into the dewatering drags already mentioned.

British Cement Combine Would Control Output

A proposed British combine in the cement industry will control about 85 per cent. of the United Kingdom output, according to recent announcements. Negotiations initiated in December, 1937 are expected to result in an offer by the Associated Portland Cement Manufacturers, Ltd., to acquire the entire common stock of Alpha Cement, Ltd., and if the deal is completed the Tunnel Portland Cement Co. will participate.

Of the total United Kingdom capacity, estimated at 8,000,000 tons, the share of the Asociated Portland Co., the largest producer, is about 4,500,000 tons, while the Alpha works can produce about 1,200,000 tons, making a total of 5,700,000 tons for the two companies. The annual capacity of the Tunnel Company is estimated at one million tons.

Crushed-Stone Group Takes Stand on Relations of Government to Industry

ONE of the closing features of the National Crushed Stone Assn. convention at Cincinnati was the adoption of the report of the association's *Committee on the Relations of Government to Industry.* The report, presented by Otho M. Graves, chairman of the committee could not be published in the February issue because of space limitations. It was as follows:

"The crushed-stone industry joins with all other industries of the nation in affirming its earnest desire to coöperate wholeheartedly with the government in the effort to effect needed reform such as cessation of monopolistic control and of undue power of unwarranted concentration of capital; the creation of more work at shorter hours with better pay; wholesome and reasonable labor relations; abolition of child and sweat-shop labor; a more equitable distribution of the manufactured wealth of the country;—all leading to greater purchasing power with consequent increased production and more leisure time in which to enjoy those necessities and comforts which flow as the result of profitable employment.

"Such a program, however, must presuppose healthy industry. At present industry is sorely stricken and therefore can not contribute as it otherwise could to this program of reform. Its shoulders are weighted down by burdensome taxation almost greater than can be borne. It is forced to thrive as best it may with fear in its heart; fear as to unthinking biased popular prejudice aroused by skillful oratory; fear of the as yet fully unknown effect of certain federal statutes; fear of the threat of further federal legislation yet more increasing its illness; fear indeed that there is a concerted attempt to undermine the system of private enterprise for profit upon which this nation was founded and upon which it has progressed so that it is now the leading industrial nation of the world. These fears are not alleviated or lessened by the public statements and speeches of apparently authorized government spokesmen viciously attacking the conduct of industry and business, laying down as they do, a withering barrage of attack and inflaming public opinion. After such attacks have been publicized but little of the damage is repaired by the assurance that only a certain small percentage of industry or business is to be so castigated. All industry and business suffers and is suffering from such attacks upon its integrity and aspersions upon its motives.

"If in fact there be malefactors, whether or not of great wealth, they should be tried by legal process of law in the courts of proper jurisdiction. The radio should not be used for indictment, trial and condemnation by government spokesmen.

"The firm foundations of American industry can not be shaken and disturbed without endangering the entire super-structure of American life. There is no need to labor the point that the entire country is nervous at present; fearful of the future, a condition which is not relieved by inflammatory utterances from authoritative sources. In such an atmosphere it is idle and absurd to inquire why private capital does not come out from its hiding places and profitably invest itself in construction enterprises. It can not be enticed from its burrow by pleasant words from those who threaten its annihilation. Obviously, idle uninvested capital is unprofitable not only to the country but to the holders thereof. It must be their desire to put it to work but only under conditions which give promise of reasonable safety. Capital has not been on a "strike"; rather it has been prevented from entering normal fields of expansion and development by certain ill-conceived legislation, and the instigation of distrust of business and industry. This is as true of the small investor with his few hundred dollars as of the large segregations of capital which in reality are the ones under attack. No such distinction is made clear to the man in the street and he merely believes it an unsafe time to invest, and so hoards his savings.

"The present recession can not be stopped nor constructive progress be made nor ultimate prosperity result under such a condition of affairs. The crushed-stone industry as a part of all industry hereby affirms its belief that:

1. Private enterprise for private profit free from the abuse of monopolistic practices should be encouraged and stimulated.

2. The government should promptly announce a long-term policy of understanding coöperation with industry thus relieving it of its present doubts and fears as to the future.

3. Oral and written attacks from authoritative sources upon the integrity of industry for the purpose of inflaming public opinion should immediately cease.

4. Those who by their acts in industry and business offend the laws of our country should be brought to summary trial through due process of law.

5. Anti-trust laws should be clarified so that the industrialist is left in no doubt as to the line beyond which he may not go.

6. The undistributed profits tax should be abolished and the capital gains tax should be materially reduced. Both of these taxes in their present degree of magnitude have contributed to the present recession.

7. The government should consult representatives of industry and business at least as freely as it does labor leaders, agriculturists, economists, and all others who can constructively contribute to the welfare of the nation.

8. The budget should be balanced and ultimately the public debt reduced, a circumstance which would enormously strengthen the confidence of the nation and stimulate the energies of its people.

"With such a governmental policy in full effect and operation the coöperation of industry and capital would be forthcoming in an unstinted degree. Industry would then be enabled to:

"1. Improve labor relations.

"2. Constructively strive to alleviate the effects of the recession.

"3. By sound and wholesome management in an atmosphere of understanding and confidence, encourage the investment of idle capital thus creating more jobs for more people.

"4. Fully coöperate with agriculture and responsible labor organizations.

"5. Work for international peace and especially that of our own land.

"The crushed-stone industry believes that the foregoing skeleton outline of the relation of government to industry is one which we could accept with confidence and build upon with success to the advancement and betterment of the social and economic structure of the nation and its citizens. It is not our desire to criticize except constructively. We have no political bias or prejudice. We are merely expressing our conception of a policy between government and industry that would encourage initiative; reward successful effort; and induce the investment of private funds, to the continuance of our economic system with increased material and spiritual benefit to our people.

"While particular federal statutes are of less importance to recovery and progress than is a well-defined coöperative understanding between government and industry, agriculture, and labor, there is nevertheless certain federal legislation, existing and pending, which is of definite and specific concern to our industry. In commenting upon it we treat first of what more especially concerns the crushed-stone industry and then proceed to matters of wider import affecting all industry.

Federal Aid for Highways.—"By the act of June 16th, 1936, the Congress authorized appropriations totaling $216,500,000 for each of the fiscal years 1938 and 1939 for federal-aid highways, secondary or feeder roads, elimination of grade crossings, forest highways, roads, and trails and highways across public lands.

"In the message of November 27, 1937, from President Roosevelt to the Congress, he recommended that the Congress adopt the following policies:

"'*First.* Provide for the cancellation of the 1939 authorizations prior to January 1, 1938, by which date the Secretary of Agriculture is required to apportion to the various States $214,000,000 of such authorizations.

"*Second.* Limit to not more than $125,000,000 per annum all public-road authorizations for the fiscal year 1940 and for each of the next few succeeding years.'

"This recommendation was not favorably acted upon and therefore the appropriation above mentioned is in full force and effect.[1] In refusing to act favorably upon the recommendation the Congress must have considered that the government had entered into a moral contract with the states to match monies raised by state taxation. More than forty of the state legislatures meet only once every two years; their highway appropriations were made on the basis of federal aid as expected by the act of the Congress referred to.

"While our industry is sympathetic with the desire expressed by the President in his message of November 27, 1937, 'to reduce expenditures for the purpose of securing a balanced budget' and in fact urges the necessity of this fiscal policy, it nevertheless believes that no public expenditures furnish more labor or are more really useful to the country per dollar of investment, than the funds devoted to highway construction and maintenance.

"In connection with curtailment of federal appropriation for highways, it should also be borne in mind that Sec. 12 of the Highway Act, approved June 18, 1934, provides that any state which collects money from those who use the roads and do not spend it on highway construction, maintenance or improvement may be penalized to the extent of one-third of its normal federal aid. In fact the section referred to starts:

"Since it is unfair and unjust to tax motor-vehicle transportation unless the proceeds of such taxation are applied to the construction, improvement, or maintenance of highways, after June 30, 1935, federal aid for highway construction shall be extended only to those states that use at least the amounts now provided by law for such purposes in each state from state motor vehicle registration fees, licenses, gasoline taxes, and other special taxes on motor-vehicle owners and operators of all kinds for the construction, improvement, and maintenance of highways and administrative expenses in connection therewith. . . ."

"That this law is in active effect is indicated by the fact that New Jersey has been actually penalized for diversion. Pennsylvania, apparently under threat of the law, restored over $19,000,000 of diverted funds and Maryland over $3,000,000. It is reported that both Georgia and Massachusetts are preparing to make restitution of diverted funds.

"Such being the policy of the federal government, as provided by law, it is highly inconsistent that the federal government itself should be guilty of diversion of motor vehicle funds. In 1936 the federal government received in taxes on gasoline $179,955,000 and from taxes on other items connected with highway use, such as lubricating oil, tires, automobile parts and accessories and automobile and truck excise, a total of $140,495,000, making a grand total of receipts of $320,450,000. By act of the Congress $214,000,000 of this amount would be returned to the states under certain conditions for highway construction improvement and maintenance. The recommendation of the President to the Congress to limit federal aid to not more than $125,000,000 per annum would constitute drastic diversion of motor-vehicle funds even considerably below the amount received directly from the federal tax on gasoline.

"It is not unnatural that our industry should support and urge liberal federal aid for highways and should vigorously resist continuance of diversion of motor-vehicle funds either by the federal government or by the states, because the products of this industry are used so largely in highway construction. With admission, however, of this selfish interest of our industry, we contend that road improvement, construction, and maintenance are of vital value to the citizens of this nation. It is estimated that the highways are at present being used by almost 29,000,000 automobiles, trucks, and buses daily. Improved highways reduce the cost of transportation and render available to urban dwellers ready access to suburban communities and increase to the agricultural population of our people, by lowered transportation costs of farm-to-market roads, the profits which they might justly expect from the fruits of their labor, and further give to them a comforting sense of time closeness to urban communities. They are also drawn closer to better educational facilities for their children.

"In view of the death of more than 37,000 people last year upon our highways and injuries to 1,300,000 the necessity for an intelligent and continued program of improvement of highways from the standpoint of safety is obvious. It is well recognized that an adequate well-maintained highway system throughout the United States is of fundamental value in time of war.

"There is probably no form of public construction in which a higher percentage of the money expended reaches

[1] [This recommendation has since been withdrawn and the Secretary of Agriculture has asked the states to submit their road plans as usual.—Ed.]

labor either directly or indirectly, nor any form of public expenditure which is of more real value and service to so large a body of citizens.

"While we recognize and urge that the federal government and the several states should practice rigid economy, we believe that there are other government and state expenditures which could be reduced with less hardship upon our people than those relating to highway construction and improvement. We believe that liberal federal aid should be continued and that all forms of diversion of highway funds to purposes other than the fundamental one for which they were intended should be discontinued.

Train-Length Bill.—"During the last regular session of the Congress a bill was passed by the Senate (S69) which would limit to 70 cars the length of freight trains operated in interstate commerce.

"The crushed-stone industry, while admitting a special and particular interest in the welfare and prosperity of the railroads, because so large a proportion of its products is sold to them as ballast, nevertheless recognizes with other industries that the financial stability and sound operation of the railroads are essential to the economic industrial and agricultural development of the country and required by the social needs of our people.

"We are opposed to the enactment of this bill into a statute for the following reasons:

"1. Railroad accidents have shown consistent reduction during the past fifteen years during which period there has been a steady increase in freight train lengths.

"2. It is urged that fatalities and injuries due to surge and shock through slack-actioned trains are more likely to occur on long trains. Statistics show that such accidents are a very small percentage of the total of all accidents to train personnel, and have decreased at an even more rapid rate than the total number of accidents during these fifteen years.

"3. Various types of accidents to train personnel are proportioned to the number of trains run. The increase in such accidents as a result of the additional number of trains necessitated by train-length limitation would more than offset any possible reduction in accidents from surge and shock.

"4. The peril and hazard to railroad passengers would be increased by increasing the number of additional freight trains.

"5. Grade-crossing fatalities are several times more numerous than all other types of fatalities to train personnel and passengers. The liability of such accidents would be increased by running additional freight trains.

"6. Statistics indicate that to limit train length would result in an increase of those accidents and fatalities.

"7. The railroads have invested heavily in plant and equipment to render possible the movement of freight trains in excess of seventy cars. Such investment would be largely lost if this bill were enacted.

"8. The mass movement of through freight on main lines is accomplished by the use of long heavy trains. This movement expressed in ton miles is the mainstay of the Railroad systems. The feeder services largely employ short trains.

"9. Limiting the length to less than 70 cars is to seriously imperil large-scale low-cost rail transportation upon which depends the mass distribution of goods to the benefit of producers and consumers.

"10. The enactment of this bill into a statute would necessitate heavy expenditures, new equipment facilities, large annual carrying charges and further expense in the waste involved in existing plant and equipment designed for handling longer trains. It is estimated that the total cost would amount to several hundred millions of dollars a year. Such additional expense should not now be placed upon the railroads in their precarious financial position.

"11. The railroads would have to endeavor to pass this vast increase in expense to the shippers and public through higher freight rates to the disadvantage of every one concerned.

"12. Train lengths best suited to various territories and conditions should be left to the determination of management as an integral part of its responsibility to provide the public with efficient and economic transportation, to protect their personnel, and passengers, from undue hazard and peril and to earn such fair return on investment as will insure the continued private operation of the railroads of the nation.

Anti-Trust Laws.—"We agree with the statement from the President that our anti-trust laws need revision. While we are in accord with the fundamental principle of these laws, their effect is to obstruct sound and useful coöperative endeavor to maintain free and open competition within the bounds of reason and fairness. We advocate an intelligent revision of the anti-trust laws and their clarification to keep pace with the conditions and needs of the commercial and industrial life of the present day.

"Particularly does the Robinson-Patman Act, which we discuss later and which drastically modifies Sec. 2 of the Clayton Act, need clarification. The difficulties confronting industry by anti-trust laws lies in their uncertainty. Industrialists are desirous to obey the anti-trust laws if they can determine their intent and meaning. Proper and reasonable industrial coöperation is blocked by a fear of the anti-trust laws which may be in fact in excess of their actual scope. Legal minds find grave difficulty in interpreting these laws clearly despite more than forty years of judicial decision. The business man is lost in the haze of doubt and uncertainty.

"We agree with those who favor giving the Federal Trade Commission the power to express an advance interpretation as to whether or not specific business practices are in conflict with the anti-trust laws. We believe that with specific practices thus approved or denied in advance, there would be less departure from the intent and meaning of the anti-trust laws and offenses of the guilty easier to prove. If any specific business practice were approved in advance by the commission such approval should afford legal protection, if later it should be held that the specific practice was in fact contrary to the law.

"We urgently recommend that in connection with the revision and clarification of the anti-trust laws some provision be made through the Federal Trade Commission for advance determination of meaning and intent as regards specifically presented business practices.

Robinson-Patman Act.—"We approve the declared purpose of the Robinson-Patman Act which is to prevent unlawful and unfair price discrimination in commerce. The continuing confusion of thought regarding the means employed by this statute to accomplish the desired result merely emphasizes our opinion expressed a year ago that we question the means adopted to achieve so worthy a purpose.

"In our judgment the administration of this act imposes upon the Federal Trade Commission a burden of enforcement too great for practical and efficient accomplishment. Even the best intentioned business man or industrialist with full desire to conduct his activities in accord with this act may find that he is subject to severe criminal penalties and not merely to "cease and desist" orders of the Federal Trade Commission. He may be subject to injunction proceedings by either the government or injured private parties and may also be liable to suit for triple damages by any persons who claim they have been injured even remotely by any practice prohibited by the act.

"When the serious and in some cases criminal nature of the penalties is considered we contend that the wording of the act should set forth the practices prohibited with clarity, and particularly, but this is not the case. For illustration the act prohibits unlawful price discrimination, but the terms "price" and "discrimination" are not defined. The accused under the act may defend himself by claiming "due allowance," but there is no definition of this term, and legal opinion greatly differs as to its meaning.

"Other elements in defense are with relation to cost of manufacturing, sale and delivery, but the term "cost" is not defined. While all those engaged in commerce are under this act subject to suits for damage by those claiming injury, the "injury" which will successfully sustain a damage suit is left vague and obscure.

"We contend that in view of the severe criminal penalties contained within the act, the language of the criminal section should be made especially clear and free from all doubt, vagueness and ambiguity. Sec. 3 which provides for the criminal penalties is no more clear or well defined than the other sections of the act.

"Our industry believes that the Sherman, Clayton and Federal Trade Commission Acts as construed and interpreted by the decisions of the Supreme Court provide adequate protection for the public interest and that it is unwise to subject industry to this new form of restraint with heavy penalities for violation of provisions vague and doubtful as to meaning. The most well-intentioned industrialist may find himself in legal jeopardy and hazard.

"More particularly our industry is concerned with the apparent lack of right to meet the delivered price of a competitor. The products of the crushed-stone industry are largely sold on a delivered-price basis, that is, plant price plus transportation charges. If in order to meet the delivered price of a competitor the plant price is lowered, a violation of the act appears to occur. True it is that the contention, that the discrimination in price was made in good faith to meet the delivered price of a competitor, may be used by the accused before the Federal Trade Commission in rebutting the presumption of guilt; exactly what this means, however, is not altogether clear except that apparently the successful urging of such a contention before the commission would shift the burden of proof from the defendant to the plaintiff.

"The act provides that nothing shall prevent a seller rebutting the presumption of guilt by showing that his lowered price was made in good faith to meet an equally low price of a competitor. However the debates in the Congress indicate that this provision does not furnish an absolute defense but was merely designed as a rule of evidence in hearings before the commission and has no effect except to deprive the commission thereafter of the benefit of the initial presumption. If this proviso may not be regarded as an absolute defense to the seller and the courts have not passed upon this question, then there is no other provision in the act which makes sales to meet competition a complete defense.

"Our industry is peculiarly subject to the hardships of this particular phase of the act and if we be debarred from meeting a competitor's price in good faith free competition suffers. If this act is to continue as a statute, we believe that it should be so modified as to render its provisions unquestionably clear; that the drastic penalties should be lessened and that provision should be made that to in good faith meet a competitor's price is a complete and full defense against the charge of undue discrimination made illegal by the act itself.

Anti - Basing - Point Legislation.—"The basing-point system of quoting and selling is rarely if ever used in the crushed-stone industry. The Wheeler bill, while aimed at the elimination of collusion and identical bidding, goes far outside this purpose. In effect it requires that all sales be made f.o.b. shipping point. If destination or delivered prices must be, as is understood to be required under the proposed legislation, the sum of plant price and transportation then provision should be made for the meeting of lower destination or delivered prices on competing materials with due regard to grade and quality of comparable use. Any one accused of a breach of the act should be entitled to show that the competitor alleged to have been injured had not made both his plant price and his transportation costs generally known. Without such knowledge of the delivered price of a competitor it is clearly impossible to meet such delivered price. Unless such delivered prices are publicly known, a producer may well quote either above, the same as, or lower than his competitor.

Patman Bill.—"The purpose of this bill is to keep the manufacturer out of the retailer's business and the retailer out of the manufacturer's business. Any proposal to sever the function of manufacture and sale vitally concerns the crushed-stone industry. Crushed stone is to the buyer merely the raw material for his own business. About 93 per cent. of the crushed stone sold is directly to the consumer; only approximately 7 per cent. passing through a retailer. To insert a middleman into the transaction would clearly add to the ultimate cost and be economically undesirable.

"The products of the crushed-stone industry are often sold at a delivered price including transportation and frequently the delivery is made by the producer in trucks, or barges, if it be water transportation, provided by him. The purposes of such legislation, with regard to the evils it seeks to abate and the arguments in favor of its adoption have no application to the crushed-stone industry. No such statute should be so drawn as to include the crushed-stone or similar industries.

"In this regard, we are encouraged by a statement attributed to Senator Patman, that he has revised the original bill (HR4722) so that the divorcing of manufacturing from retailing functions will depend upon whether the combination of those two functions appears to result in a tendency toward monopoly or restraint of trade.

Tax Revision.—"The continued recession approaching a depression is definitely emphasizing that taxes and surtaxes upon business and industrial concerns without regard to necessary and secure financing, sound business management and recognized business cycles, is ruinous to that sense of security and confidence without which prosperity can not exist. If industrial financing is again to be placed upon a sound, competent far-sighted basis then it follows that drastic reductions must be made in the undistributed profits tax.

"The President in his message to the special session of the Congress said:

" 'We should give special consideration to lightening the inequitable burdens on the enterprise of the small business men of the nation. Small businesses or even those of average size have difficulties of financing and distribution which are not shared by large corporations. Therefore by special tax consideration they should receive more equal opportunity to compete with their more powerful competitors.'

"We suggest that the issue is not the size of the levy but rather its economic soundness. It is aimed at forcing a demobilization of capital and a reduction of surplus. If earnings be not distributed and are left in reserve for the purpose of security and expansion then proportionate taxation demobilizes the capital and partly destroys the security sought. Whether a business be large or small it can not continue without reasonable surplus of capital and penalty should not be ex-

acted for prudent business management. Proportionately greater surplus is needed by the large coporation than by the small business but both need mobilization of capital corresponding to the magnitude of their business activity. Surplus can not be steadily reduced and yet be present and effective when needed as in a depression. A previous demobilization of the army is disastrous when war is declared.

"Unquestionably the capital gains tax has worked an undue hardship upon industry by tending to prevent the investment of capital.

"It is unfortunate that no provision is made in the tax laws to use as a credit against profits or capital gains, the losses in either or both of the immediately preceding year or years. Equity would demand allowance for this factor.

"We recognize that the federal government is not in an economic position to regard with sympathy the lowering of federal income through a decrease of taxes. Our industry contends, however, that a reduction or complete elimination of the capital gains tax and the excess profits tax would be of inestimable aid in placing industry and business upon a sound financial basis, the results whereof being a more effective step towards a balanced budget than would a stubborn insistence upon the present tax levies. The immediate loss of revenue from these two tax sources would be more than compensated by the added revenue from personal federal income taxes received as a result of vigorous industrial prosperity. The personal income tax may well be broadened as to base by the lowering of exemptions. This would bring home to the individual taxpayer that he is paying the bill for government expenditures.

"Our industry definitely holds that the capital gains and undistributed profits taxes should be repealed *in toto*, but if not repealed, then drastically modified downward.

Regulation of the Wages and Hours of Labor.—"The crushed-stone industry is justly proud of its record in the field of labor relations. Child labor and sweat-shop conditions are unknown and there are few industries in which dissension or grounds for dissatisfaction with conditions of employment have been so rare.

"Provisions for standardization of wages and hours, however, have a peculiarly disruptive application to this industry. In many if not in most parts of the country winter weather brings an almost entire cessation of demand for crushed stone. Public construction including road building and railroad ballasting is not commonly carried on during the winter months, thus necessitating an extended period of either complete or relative inactivity. Even during the normal operating periods short periods of cessation of demand resulting in curtailment or stoppage of operations are caused by inclement weather. Crushed stone can not be manufactured to advantage in advance of demand and kept in storage, but must be produced as presently needed. For these reasons the business is markedly seasonal in character.

"Plant maintenance and work of a preparatory character furnishes employment in part during the non-operating season but can not maintain payrolls at the higher levels reached during the period of production.

"Any arbitrary limitation of hours of labor in our business must result in hardship to the worker by preventing him from working longer and earning more in the busy months to compensate for loss of earnings in the slack season.

"The President in his message to the Congress on January 4, said:

" 'For economic and social reasons our principal interest for the near future lies along two lines: First the immediate desirability of increasing the wages of the lowest paid groups in all industry and, second, in thinking in terms of regulating the work of the industrial worker more generally through the year—in others words, in thinking more in terms of the worker's total pay for a period of a whole year rather than in terms of his remuneration by the hour or by the day.'

"An adherence to this far-sighted policy would reduce costs in those industries where it was applied and increase the annual earnings of the workers employed in them. In a seasonal industry further subject to the effects of inclement weather and in which it is not practicable to store production, we see nothing unfair and believe it economically sound to allow an employee to work somewhat longer than the usual hours during the times when the demand for the production is larger in order to make up for lesser hours of work during those times when the demand for the products ceases. On the contrary we contend that the spirit and intent of any regulation or statute placing a ceiling upon hours can be carried out in an industry such as ours only by permitting the averaging of hours worked. A failure to do so would be definitely unfair to the labor employed.

"Minimum-wage provisions are relatively unimportant in our industry where wages generally are above the suggested minimum.

"We think, therefore, that as to the crushed-stone industry the minimum wage provisions of the Walsh-Healey law are unnecessary and that the maximum hour provisions are a handicap to both the industry and the workers engaged in it and that this law should be repealed. Our reasoning would be the same in connection with any similar proposed wage-and-hour law.

The National Labor Relations Act.—"The crushed-stone industry opposed the passage of this legislation originally and observation of the act in operation impels us to reaffirm our objection. The effect of the act has been to magnify dissensions between employees and employer and even to promote dissension where none existed. To an industry comparatively free from such troubles the further continuance of this law presents a menace for the future, harmful alike to all who live by industry whether employer or employee.

"Seven Little T.V.A.'s".—"As indicated by the name popularly applied to this bill, there would be created seven regions in the United States, each under a regional authority for the declared purpose of development of natural resources. It is predicted that this bill will receive considerable attention during the present session of the Congress. It is objected that such regional authorities would supersede state authorities in such matters as prevention of pollution of streams, flood control, irrigation and power development. Moreover there might well be disturbance of long-standing customs, compacts or coöperative understandings between states in such matters.

"A more serious objection, however, is the unnecessary cost of these regional authorities which in many instances would function merely as a superfluous agency between the state and national authorities.

"A more fundamental argument against the passage of this bill lies in the fact that it would enable the federal government to enter into the domain of business and industrial development under the powers inherent in the seven regional planning authorities.

"Any enormous investment by the government would not only be required but the federal government would enter into industry on an heretofore unknown scale.

O'Mahoney-Borah Bill. — "The O'Mahoney-Borah Licensing Bill (Senate Bill 3072) has for its general purpose a compulsory control of industry through a system of federal licensing. This bill supersedes the original O'Mahoney Bill upon which extended hearings were held during 1937. It is not unlikely that proposed legislation, with particular respect to wage and hour

control, may result in bringing political support to the O'Mahoney-Borah Bill.

"By its statement of purpose and its definition of terms, the bill sweeps away the traditional distinction between commerce within state boundaries and commerce across those boundaries, and the distinction between production and commerce. It includes under its wide embrace virtually all business activity within the nation.

"The first title of this bill outlines the organization and duties of the administrative agency; sets up the licensing scheme; imposes labor and fair-trade conditions; establishes the procedure for securing licenses and the conditions under which they may be denied, revoked or reissued; and the general powers of the administrative body include extensive powers of investigation.

"The second title is concerned with the 'Protection of Investors'. It provides a regulatory code for all corporations and includes provisions as to relations with stockholders; the use of proxies, restrictions on bonuses and commissions to officers and directors; limitations on corporate surplus, provisions for profit sharing with employees; limitations on the right to serve as an officer or director of a corporation; and other provisions which would have the necessary effect of modifying policies and practices of corporations now permitted or even required by the laws of the states of incorporation.

"By this bill control would not be confined to those corporations evidently requiring the necessity of some regulation; the licensing system would apply to all corporations whether large or small and to any kind of business venture, whether or not incorporated, and whether or not conducted by a group or a single individual. In fact the term 'corporation' is defined as 'any body, corporation, association, trust, joint-stock company, limited partnership, syndicate, group, pool, joint venture, or other unincorporated venture'.

"The measure would be administered by the Federal Trade Commission, the personnel of which would be increased from 5 to 9 commissioners. Before issuing any license the commission is required to secure from the applicant a sworn statement with respect to its operations which includes a vast amount of corporate detail which is listed in the bill and in addition such further information with respect to operations of the corporation as the commission may require as necessary or appropriate in the public interest.

"The bill is replete with penalties, such as:

(a) Denial of the right to engage in commerce as defined in the act unless a license has been secured.

(b) Denial of license under certain circumstances.

(c) Right to revoke licenses.

(d) Voiding of every contract made in violation of the act.

(e) Maximum fine of $10,000 and imprisonment for five years in the case of individuals.

(f) Maximum fine in an amount not exceeding ..... per centum of its capital stock in the case of a corporation.

(g) Right to issue a perpetual injunction against engaging in commerce in the case of either an individual or a corporation.

(h) The prohibition to act as a representative or proxy of a corporation without a certificate from the federal government under penalty of a fine of $1,000 for each offense.

"There are other prohibitions and imposed conditions too numerous to mention herein. It is obvious that the O'Mahoney-Borah bill is a proposal with far-reaching consequences. Upon the presumption that certain evils exist in exceptional cases this bill proceeds to impose upon all industry and trade a drastic and minute Federal control, compulsory to an amazing degree.

"We suggest that the bill confers upon the Federal Trade Commission a discretion as unlimited and unfettered as that condemned by the Supreme Court under the National Industrial Recovery Act. It includes drastic powers of investigation and inquiry with the right to publicize the intimate and confidential concerns of all persons or corporations engaged in commerce. It appears that the Federal Trade Commission would be given powers in fields already occupied by the states and would be given a dual and conflicting jurisdiction with the National Labor Relations Board, the Securities and Exchange Commission and similar agencies of state governments. It imposes control upon control and regulation upon regulation. The penalties of the measure are extremely drastic, ranging from heavy fines and imprisonment to banishment from commerce. Any person required to operate under a license who engaged in a single act without a license would, at the discretion of the commission, be a business outlaw. A license could be revoked for trival or technical violation of the terms of the license.

"Although the act is comprehensive in its requirement of a license to do business, its application may be still further extended by the commission which may upon its own finding subject any person to its provisions.

"A license may be denied except upon conformance to such terms and conditions as the commission may prescribe as necessary to carry out the purposes of the act, and shall be denied if the commission find the applicant guilty of a breach of the anti-trust laws. Once granted, a license may be revoked by the commission for violation of any effective term.

"Without a license no one falling under the terms of the act, or brought under it by the commission's extension of its provisions to him, may transact any business. He is an outlaw.

"The only protection to the citizen against economic attainder at the hands of the commission lies in an appeal to a Circuit Court of Appeals. Unless the court specifically grants a stay, the commission's order stands until the appeal is heard and decided. A flood of such appeals, congesting court dockets, might prolong the period of interdict with the consequent shut-down of office, plant, and factory. And when the day in court comes, the jurisdiction of the court extends only to matters of law, and the findings of fact by the commission (apparently even findings as to violation of the anti-trust laws) remain conclusive 'unless it shall clearly appear that the findings of the commission are arbitrary or capricious.'

"The practical result would be to place all industry and business in the almost absolute control of a governmental agency. The manifest unworkability of such a dream of collectivism, does not palliate its flagrant disregard of the treasured traditions of a free people. In a country where liberty of thought and speech, and the equality of rights for everyone is the basic belief, a destroyed economy results in the destruction of the ideal of a free government.

"Our industry is opposed to such drastic governmental control of all industry, business and commerce. We believe that through such a measure the government exceeds its rightful and just function of government. We condemn the extremes of this bill, its severity, and almost unlimited discretion conferred upon an administrative agency, its duplication of existing laws and other agencies, its conflicts of jurisdiction with the states as well as with governmental agencies, and its administrative difficulties.

"Such a measure is in our judgment not a wise and intelligent approach in the seeking of improved labor and living standards in this country. We condemn it as an unsound and unwise government policy."

RESEARCH IN THE AGGREGATES INDUSTRY*

By Prof. C. H. SCHOLER
Kansas College of Agriculture.
Chairman, Dept. of Materials and Construction, Highway Research Board, National Research Council

FROM the beginning of human kind, man has been a restless, dissatisfied animal unwilling to live as his father did, or where his father did; continually trying to change his environment and habits. It is this willingness to try something new, to change whether for the better or for the worse, that has distinguished man from the other animals with whom he was placed in competition. Not very well adapted to live either on land or sea, or in the air, he now thinks he is master of all, and makes each do his bidding. Rather a weakling among the larger animals of the earth, even the most primitive of races have gained ascendancy over the beasts of the field.

Although not for many thousands of years dignified by so high sounding a name as "research", yet it is the same spirit that now evinces itself in research that has in ages past made man a progressive and dominant creature. Not all races or people have been equally restless and curious; some have been content to live the old life, live in the old home, eat the old food, and wear the same old clothes, if any. These races have become the "white man's burden", and these peoples have been of much concern to enlightened nations with high standards of living like the Italians, English, French, or Americans.

The fate of man-made organizations follows much the same pattern as his individual life. So long as his organizations are active, growing, and changing they endure. As soon as they tend to become static and satisfied with the *status quo* they wither and perish. This is equally true, whether the organization is a nation, a corporation, or a trade association like your own. Even a political party must have some new ideas, if it wishes to remain in power or to regain its power.

Charles F. Kettering, head of the research division of General Motors Corp., says that research is nothing but looking forward to see in which direction industry may or may not go. A research organization of some sort is now accepted as part of the organization of every large industry or association of industries such as yours. Research is now in good standing generally, is good copy for news stories, and, like some people, finds popularity and prosperity hard upon its reputation. Too many advertising departments have adopted the homeless waif, "research", and set it to writing copy. As a result, we see the weaknesses and faults of the industry's product headlined in all the leading papers and magazines, and learn that after years of painstaking research some learned Ph.D. has developed a process that makes it "kind to your throat", "keeps you kissable", "picks you up and never lets you down", "will cure dandruff, halitosis, pyorrhea, lame back, or acne". Some of our most creditable research agencies are found in trade associations and other large industries, but the high-grade work of such organizations as the research laboratory of the Portland Cement Assn., General Motors Corp., and Bell Telephone Co. are almost lost and discredited by the smoke screen of psuedo-research that floats out of the advertising managers' offices of thousands of concerns selling mouth washes, cigarettes, tooth pastes, antiseptics, gasolines, lubricating oils, and what have you. One of the things to be closely guarded against in any research program is the tendency to let it become merely an adjunct of the advertising or sales department.

Your association is to be congratulated for having recognized rather early in your history the importance of research; you have not prostituted your program to cheap advertising. You have selected the best-qualified man in the country to head your research organization, and have equipped a modest laboratory efficiently and well. I wonder if you have provided a budget that will enable your director and the laboratory to employ a staff of men to produce the results you have every reason to expect? Have you ever tried spending as much annually on your research organization as an annual convention costs you? I mean the real cost of the convention — transportation, hotel, meals, liquor, shows, throw in your time during which you probably wouldn't have earned anything if you had stayed home. Without being inquisitive, I would like to know if you ever had a research budget that large.

I am reminded of the colored boy who, several years ago, was working on the levee down around New Orleans. He had long wanted to own a watch, and finally was lucky with the numbers and got a good one. The next day at work a pal noticed the gorgeous timepiece and asked Jim, "What time am it?" Now Jim had never learned to read anything, not even a watch, but nothing daunted, drew the watch with a great flourish and displayed the face to his friend and said "Dere she am", and Mose replied, after looking with awe upon the shiny timepiece, "Damn if she aint".

Can you tell what time you are making with research on your product? Can you do much more than point to your research organization and say "Dere she am!"

It might be well to list some of the things which a research department or organization might be expected to do for an industry such as yours:

1. Develop new uses for the product, or introduce its use in places or processes where another product or material has been used.

2. Develop new processes of production preparation or handling of the products to improve the quality or lessen cost of production, or both.

3. Do "trouble-shooting" for members who are in difficulty with purchase specifications of customers and their tests.

4. Do "trouble-shooting" for the industry and its members when competing materials have become too aggressive, or their producers have misrepresented their product as it relates to yours.

5. Study the failings and weaknesses of your product and be prepared to meet the problem by changed processes or separation of material and diverting the unsatisfactory material to other uses.

6. Items 3, 4, and 5 should, in so far as possible, be anticipated and a solution or specification be planned to meet the emergency.

7. Be of assistance to customers in developing sound, economical and fair specifications covering the purchase and use of your product in construction.

*Presented at 21st Annual Convention, National Sand & Gravel Assn.

This list may look like a large order, and it is. To do this adequately would require a staff of highly-trained and experienced men with a well-equipped laboratory adequately financed.

Probably one reason why the average business concern has difficulty in setting up an adequate budget for research is that lack of certainty as to the results that will be secured. Any man likes to know what he is going to get for his money. While we people who are engaged in research are certain that in the long run you will get much more than your money's worth out of your research budget, nobody can predict in advance just what a real research project will cost, when it will be completed, or what the answer will be. Mr. Kettering's idea is that the cost of research should be accounted for in the same way that insurance costs are accounted for—on an actuarial basis average the successes with the failures and do not expect each project to show up on next year's business. Research is the industry's insurance that there will be business in the future. None of you would consider dropping all your fire insurance because you had had no fire the past year.

If you will cast your eyes over the industries of the country as a whole, you will find that almost without exception those that have made the most outstanding successes have maintained large and efficient research organizations. Instead of curtailing their research staffs as business slumped, they increased their activities, realizing that only by new products, new uses for the products, and lower prices could they hope to regain lost markets. I am sure that never in the history of the automotive industry were improvements made as rapidly and price cut so steadily as they have been the past five or six years. The same thing may be said of the chemical industry. Such recovery could not have been made had they been content to keep on producing the old models, using old ideas, and saving money on research and development.

Your own industry is, of course, different from the automotive industry. One of the new outlets for your product has started to develop—the so-called stabilized road. Did you significantly contribute to this development? I am inclined to think you offered but very little help. The impetus for this development came from chemical industries who had a by-product (salt) to dispose of. Occasionally rich fruit like this will fall into your lap, but an aggressive, forward-looking policy will, I am sure, produce much better results. I am sure your industry is always willing to put up funds for "trouble-shooting" after it is too late to stop the trouble. When some large user of materials writes in a soundness specification that eliminates completely the product of several plants, it would be a simple matter to raise ample funds to try to show why this specification was unworkable. But the real time to do this is before the specification is written. Many of you can recall the lively time you had a few years ago when a certain state introduced some drastic soundness tests for sands. Had your research laboratory been adequately equipped with a staff of field engineers as well as a laboratory staff, I think it is likely that at least some of this might have been foreseen and your research staff could have either offered a guiding hand in preparing such specifications, or perhaps offered better specifications and requirements in their stead. Even yet, engineers all over the country are searching diligently for tests by means of which the soundness of an aggregate and of the concrete made of this aggregate may be predicted. The need for such a test is imperative, and you may rest assured that engineers in charge of the preparation of purchase specifications are going to write in some sort of test requirement.

It would not sesem unreasonable that the National Sand & Gravel Assn., the largest association of aggregate producers in the world, should be a leader in such a study. Are you assuming such a position of leadership? Is there a program of investigation now being carried on by your organization in the field and in the laboratory? Whether or not you have a voice in the investigation and preparation of test requirements is entirely a matter of your own choice. The specifications will be written; you will have to attempt at least to produce material to meet them, and if they are hastily and improperly drawn it will cost more to combat the error and reëstablish your product, if necessary, than it would to participate actively in such an investigation.

Do not be too critical of engineers who sometimes have a hand in the preparation of such specifications. It is necessary to do something. Too many structures are showing inadequate resistance to the weathering forces of nature. This lack of durability may be due to one or all of many factors—the cement, the aggregate, the proportions of the ingredients, or the method of manufacture, which includes mixing, placing, and curing. One of the major constituents of concrete is your aggregate, and all engineers worthy of the name would welcome the leadership of your organization in helping to solve the problem. The real trouble in the aggregate industry occurred when the Lord failed properly to sort the junk He collected between the Arctic circle and the 39th parallel of latitude and dumped it at the foot of the glacier. He was equally careless when He buried the remains of miasmatic, Pre-Cambrian mosquitoes, progenitors of little-neck clams and other poor fish with alternate layers of Devonian mud, Silurian shale or Cretaceous sand which later consolidated into what some optimistic *entrepreneur* has dignified by the name of quarry.

An almost untouched field for the use of sand and gravel is developing in the increased use of bituminous materials in highway construction. Gravel has not been one of the favorites in this field. Your competitors' product has long been looked upon with favor. Is there any good reason why you should not enter this field? Do you have the facts at hand as to the service rendered by your type of product where it has been used in such construction? Some of these projects have been very satisfactory; some have been very unsatisfactory. Was it because your material was gravel that it failed to give the results anticipated, or were some of the many other variables that enter into the construction product responsible for the unsatisfactory results?

Your product is nearly always used in conjunction with other materials such as asphalt, cement, calcium chloride, road oil, or tars. The organizations producing these materials are following their work much more closely than you are, and although they are honest and sincere in their efforts to explain why a certain project was disappointing, they will not be averse to letting the general idea be known that probably the aggregate was unsatisfactory. And likely as not it was. If it was unsatisfactory, your association should know it, should know why, and avoid using sand or gravel having such characteristics in the same type of construction.

In the fields of concrete construction and bituminous construction there is a growing appreciation of the fact that not all gravel is alike, nor all sands alike, nor all crushed stones alike in their reaction to the materials with which they are mixed. What is this difference? I do not know. The surface of contact between the Portland-cement paste or the bituminous material is the most important unit in

(Continued on page 68)

LEFT—Molten slag being poured from ladle into expanding pits containing water. Water added during pouring reduces possibility of producing dense slag.

By G. F. FRANCE
Engineer, Hudson Valley
Fuel Corp.

NEW PLANT PRODUCES LIGHTWEIGHT SLAG

BLAST-FURNACE slag to-day is the raw material for a rapidly growing industry which should substantially aid America's drive for lower-cost building construction. Evidence of existing slag dumps, the records of slag disposal costs in blast-furnace operation, the relatively few patents listed under slag, and the little published information on slag utilization show that American economic conditions have kept science too busy in other fields to realize the possibilities of slag as a raw material for new industries.

It has been only within the last few years that the country's research committees have devoted attention to slag utilization, and with much avail. Experiments on foamed slag as a light-weight aggregate for concrete have been carried on by the Blast-Furnace Committee of the Iron and Steel Industrial Research Council. The A.I.M.E. Blast-Furnaces and Raw Materials Committee shows (A.I.M.E.,T.P. No. 796) a promising future in slag-glass possessing properties superior to soda-lime glass yet cheaper to manufacture. Other common industrial uses of slag at the present time are slag-wool, molded and annealed dense slag units, machine-expanded slag, slag for cement, and dense slag aggregate.

It was with this picture in mind that the Hudson Valley Fuel Corp. of Troy, N. Y., producer of gas for the Albany, Schenectady, Troy areas, which maintains a blast-furnace that provides an outlet for by-product coke, decided to utilize slag, the disposition of which

The slag plant with old hopper-bottom car used as receiving hopper or wharf.

was becoming an increasing problem. To meet this problem its use as a light-weight aggregate for concrete seemed the most practical, both from the production and marketing viewpoints. Still, the field of light-weight slag aggregate was so new that a plant for its production could only be justified on an experimental basis. Such a plant was put into operation late in 1937. Ordinary crushed slag can also be produced.

The plant lay-out consists of expanding pits, a crane equipped with an extra-heavy clam-shell bucket provided with teeth, a crushing and screening plant, and a belt-conveyor for loading the barges. Molten slag is brought by a steam locomotive and cars to the expanding pits, where each ladle is poured into a pit containing an initial amount of water, to which more water is added through a 3-in. pipe at 30 lb. pressure during the actual pouring of the slag. This makes a total of 10 to 15 per cent. by weight of water to slag. Before pouring, the slag is allowed to cool in the ladles to a temperature only 300 or 400 deg. F. above the point of solidification. It is then poured at the rate of approximately 1 ladle per min. The resulting cooler slag, which is more easily commingled with the water, produces a more thorough steam activation of the gummy molten slag, leaving an amorphous air-celled structure at a fairly high temperature, which is, of course, free of moisture. Water, jetted into the pit during pouring, also aids the steam activation, and reduces the possibility of producing dense slag. Only sufficient water to foam the slag is desirable, as an oversupply tends to produce granulated slag. The pouring should preferably be completed before the foamed slag has been chilled. If it is poured too rapidly, steam pressures may develop which will throw molten slag back out of the pit. The cellular slag is given a day to cool to a workable digging temperature, during which time it anneals, as does glass in the annealing lehrs used in glass manufacture, producing large pieces of tough clinker. It appears as though dense or expanded slag fractures into pieces, the size of which varies with the cooling time.

The expanding pits are 9 ft. by 15 ft. and 17 ft. deep, and are in two rows between earth-filled trestle tracks. The trestle fill is supported by rubble-masonry retaining walls, laid up of ladle sculls, with molten slag as a binder. The molten-slag binder is confined to the wall by a mortar seal, thrown against the external face of the wall with shovels.

To keep the crushing and screening plant in the experimental class, nearly all the material and equipment was second-hand. The frame of the plant

The gyratory primary crusher with belt-feeder and magnetic-separator pulley.

building is of structural steel; the floors, elevator shaft and bin sheathing are of culled oak. Fabrication of the structural steel was accomplished by burning, reaming, bolting, and electric welding. An old coke hopper car seemed to be the quickest answer for a surge wharf to receive clinker brought direct from the pits by the crane. The working angle of repose of the clinker in the car wharf is about 45 deg., as this reduces abrasion on the car floor.

An unusual feature of the belt-feeder which travels at the rate of 60 ft. per min., is a current relay control connected in series with the 50-hp. motor driving the primary crusher. By turning a screw in this relay the feed through the entire plant is set between very close limits, as the feeder motor stops and starts with the horsepower drawn by the primary crusher.

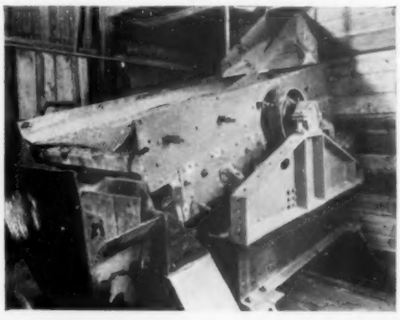
The plant has excellent lighting and is supplied throughout with water and air outlets. Plans have been made for a dust-collecting system. All the motors are interlocked so that the plant may be stopped from conveniently-located push-button stations, and an overload on any machine will close down all the preceding machines in the line of flow.

The crushing plant operates at about 30 tons per hr., which is equivalent to approximately 55 cu. yd. per hr. of crushed expanded slag. Our records show a pit digging rate of 10 tons per hr. actual crane-digging time. This shows that the crushing plant has to operate only at intervals. One man is required to break the large clinkers through the wharf grid, and occasionally agitate the clinker to prevent it from bridging over the 2-ft.-square opening to the feeder belt. The pouring and plant control are handled under the supervision of the plant foreman.

The properties of expanded-slag aggregate conform quite closely to those of other light-weight aggregates. Users have been very much pleased with the quality of the product, and it has been possible to produce the precise gradation they have desired.

[NOTE—The following description of the plant was prepared by a member of PIT AND QUARRY's editorial staff from data supplied by Mr. France.]

Slag is fed from the car wharf or bin by a 30-in. belt-feeder into the Size 13A Telsmith gyratory primary crusher. This feeder has a magnetic head pulley to remove loose iron and is equipped with Goodyear heat-resisting belting. The crushed slag is passed over a 48-in. by 60-in. Tyler Hum-mer single-deck screen. Oversize slag retained on this screen is discharged into a Size 40 Telsmith gyratory secondary crusher. The product of this crusher, with the material passing through the Hum-mer screen, is discharged to an 18-in. Telsmith bucket-elevator on 67-ft. centers. Slag is discharged from the elevator on a Robins Gyrex 4-ft. by 8½-ft. double-deck screen. The three sizes of slag produced are discharged through chutes into storage bins. The coarse slag can, if desired, be chuted to a 17-in. by 24-in. Robins



The 4-ft. by 8½-ft. vibrating screen used for sizing the slag.

fluted-roll crusher for further reduction. The product of this crusher is discharged into the elevator already described and is re-screened.

The primary and secondary crushers are flat-belt driven by 50-hp. and 40-hp. motors, respectively. A motor-generator set supplies direct current for the magnetic pulley and the Hum-mer screen and for the 5-hp. motor which drives the feeder through a Jones spur-gear reducer and a Sturtevant reducer. The elevator is driven by a 10-hp. motor and the Gyrex screen by a 7½-hp. motor, both through V-belts. The roll crusher is chain-driven by a 40-hp. motor. All the chutes are made of ¼-in. welded steel plate with ⅜-in. chrome-nickel steel wearing surfaces.

Research

(from page 66)

the final product of the mixture and increased attention must be given to this variable in future construction work. I think your own research laboratory has given some thought and study to the variation in cements and the strength shown by these cements with different kinds of aggregate. These differences are not always unfavorable to gravel; neither are they always favorable.

In bituminous construction one of the major problems now being faced by the engineer is the phenomena known as "stripping", the inability of the bituminous coating to adhere to the pieces of aggregate. There seems to be a tendency with certain combinations of asphalt and aggregate for a film of moisture to separate the asphaltic film from the aggregate. Whether or not this is a characteristic of the aggregate, or a characteristic of the bitumen, or a characteristic of certain combinations of the two is not yet known. The tonnage that will be used in such construction is going to be tremendous. If your industry can give adequate assistance in solving some of these problems and can demonstrate that your product can be advantageously used, anything you may spend through your research staff will be negligible as compared with the profits you might gain.

All these problems are being studied and an answer will be forthcoming, whether you are able to coöperate or not. But I am sure it would be highly advantageous to your industry if you could participate in formulating the specifications and test requirements which you may be called upon to meet. Your research staff should not only help the producers out of a pinch when the specifications are too rigid, or test requirements have been inadvisedly drawn, but should also attempt to follow up every project or construction job where difficulties have been encountered and ascertain the cause. If your own product has been at fault, plan to make the necessary corrections. If it has not been at fault, get your alibi in ahead of time instead of waiting until the other fellow blames you for it.

By J. R. GRAN
Asst. Material Engineer, Cement Reference Laboratory, National Bureau of Standards

Estimating Particle Sizes in the Gradation of Granular Materials[1]

THERE has been an increasing awareness of the effect of sub-sieve fineness on the properties of pulverized materials; for example, the covering power of mineral pigments and the rate of hardening of Portland cement are now known to be dependent upon grain sizes much smaller than the meshes of the finest sieves. This knowledge and the realization of the necessity for closer control of the grinding processes, both for economy of operation and for uniformity of the product, have resulted in an intensive investigation of methods of determining sub-sieve sizes.

The determination of particle gradation is elusive—in fact, an exact determination is probably unattainable. Different approaches, advanced by many investigators, yield widely differing results, and these controversies have added to the confusion of manufacturers seeking suitable tools for testing their product.

In general there are only two principal methods in use for determining the particle gradation of granules up to 100μ. These employ: (1) microscopical examination, and (2) measurement based on Stokes' law, either by elutriation or sedimentation. Each of these methods is based upon different assumptions, and, in addition, different investigators using the same general method vary their technique and interpretation of results. For this reason it is not surprising that a marked lack of agreement is obtained. Each method has its champion, who is convinced of its superiority to all others as yielding results which approach most nearly some hypothetical "true" values of the particle sizes.

Methods for Measuring Particle Diameters. — Microscopical measurement appeals to many as the ultimate in accuracy and is referred to as a "direct" method because of its visual nature. However, there is always difficulty about the selection of the dimension to be used as the equivalent diameter of an irregularly-shaped particle.[2] Ordinarily all particles are considered to be spheres with a diameter arbitrarily selected, either that which appears to the observer as a reasonable diameter, or the dimension parallel to a fixed axis, or, in some cases, the maximum or minimum visible dimension. Other investigators use various "shape factors", which are corrections based on the assumption of geometrical similarity between particles. One such scheme is the use of the harmonic mean of three dimensions, which gives the diameter of a sphere having the same ratio of surface area to weight as a parallelopiped of the dimensions of the particle.

Another factor, which most investigators neglect entirely, is the variation in apparent dimension of a microscopic particle with variation in index of refraction of the mounting medium.[3] This variation may, in extreme cases, amount to 20 per cent. or more. Since the proper medium to use has not been determined there is an element of uncertainty in all microscopical particle measurements.

Microscopical examination is too slow and laborious to be of any great value as a routine control method; however, it is often the only method applicable to some materials, such as those composed of fibrous, flakey, or needle-like particles. Also, if used with painstaking care, it furnishes a check upon other methods. Because of its fancied exactness, it has been advanced as the ultimate standard by which all particle-size determination should be judged; a more rational view would be that, in many specific instances, the results obtained with the microscope, affected as they are by the subjective factors cited, should not be accorded any greater credence as to accuracy than those of any other method which has proved its worth in actual use.

In the elutriation and sedimentation methods (except where these processes are combined with microscopical examination of fractionated material), the diameter of a particle is defined on the basis of Stokes' law for sedimentation. That is, the "Stokes' diameter" of a particle is the diameter of a sphere having the same resistance as the particle to motion through a fluid. Applied to sedimentation only, this equivalent sphere may be defined as having the same density and falling velocity as the particle. There is no reason to believe that this hypothetical diameter corresponds to a diameter obtained from visually-measured dimensions of an irregularly-shaped particle. Since no single measurement will more than approximately describe an irregular particle's geometrical properties (such as, surface area, volume, specific surface), and as the degree of approximation is unknown, it would seem logical in the practical estimation of particle-size distribution to adopt such a definition of particle size as Stokes' diameter, which may be arbitary but is not subject to variations due to the observer's judgment. The validity of this practice has been recognized by the American Society for Testing Materials Committee C-1 on Cement for several years.

Specific Surface.—Because the speed of chemical reaction of granular materials depends on the surface area of the particles, it is customary in many industries to designate the sub-sieve fineness in terms of specific surface. This is defined as the surface area of the material per unit weight, usually in sq. cm. per g. It is calculated on

[1] Publication approved by the Director of the National Bureau of Standards of the U. S. Department of Commerce.

[2] G. St. J. Perrott and S. P. Kinney, "The Meaning and Microscopic Measurement of Average Particle Size", *Journal*, Am. Ceramic Soc., vol. 6, pp. 417-439 (1923).

[3] D. L. Bishop, "A Sedimentation Method for the Determination of Particle Size of Finely Divided Materials (Such as Hydrated Lime)", National Bureau of Standards *Journal of Research*, val. 12, p. 173 (1934).

the assumption of spherical particles from the equation:

$$S = \frac{6}{\rho D},$$

where S = specific surface,
ρ = density of material, and
D = surface mean diameter.

The surface mean diameter for a group of particles is equal to $\frac{\Sigma nd^3}{\Sigma nd^2}$, where d is the diameter of a single particle and n is the number of particles of this diameter. For fractions of relatively narrow size limits, narrow as measured by the ratio of upper to lower limit, a satisfactory approximation is obtained by taking the arithmetic mean of the limiting diameters. This is the usual practice for fractions coarser than 10μ. For material finer than 10μ, which contributes the major portion of the surface area of all fine powders, the error introduced into the calculated specific surface by assuming the mean diameter on this basis may be large.

For example, assume that on a given Portland cement it is found that 30 per cent. by weight is finer than 10μ. Theoretically, the surface mean diameter of this fraction may be anywhere from molecular size up to practically 10μ. In different cements it is conceivable that this value may actually vary from about 2 to 8μ, depending upon the grinding characteristics of the material and the type of equipment used. The contribution of this fraction to the surface of 1 g. of the whole cement would correspondingly vary from 2,800 to 700 sq. cm.

Unless the method of determining the size distribution of these minute particles can remove this element of uncertainty, no calculation of specific surface can be justified on the basis of theoretical accuracy. For practical reasons, it is impossible to separate the 0 to 10 fraction into enough subfractions to fix precisely the surface mean diameter. The difficulties encountered in microscopical examination have been pointed out; sedimentation is not applicable because these extremely fine particles tend to agglomerate before observations of their falling velocities can be made; and elutriation requires such low air velocities that clean fractionation is doubtful.

From the standpoint of manufacturing control and acceptance testing—at least of many materials—the ideal of absolute theoretical accuracy in specific-surface determination is somewhat academic. What is needed is a measure of fineness that can be correlated with the performance of the material in actual use. Traxler and Baum[4] propose the use of the volume mean diameter for designating fineness because it "emphasizes the finer fractions to a smaller degree". However, the concept of specific surface has been widely accepted by technicians in many fields because it is believed that the properties of a powder are closely related to its surface area. The present crude approximations of specific surface are considered indicative of the effect of grading upon the performance characteristics of materials and, therefore, should not be discarded until more precise methods are obtainable.

In this connection it may be appropriate to point out that many technicians making routine specific-surface determinations do not recognize the limitations to the precision of the methods they are using. One often finds results of specific surface recorded to the nearest sq. cm. per g., when in actuality the nearest hundred sq. cm. represents a degree of accuracy that is unobtainable. With this in mind it will be seen that much of the lack of agreement between different methods is more apparent than real; and also that the stubborn insistence upon the importance of the differences in assumptions is rather absurd. It is suggested that, as a basis for agreement, the assumptions that enjoy the widest acceptance should be generally adopted. At present these seem to be those of A.S.T.M. Tentative Method of Test for Fineness of Portland Cement by Means of the Turbidimeter (C 115-34 T).[5]

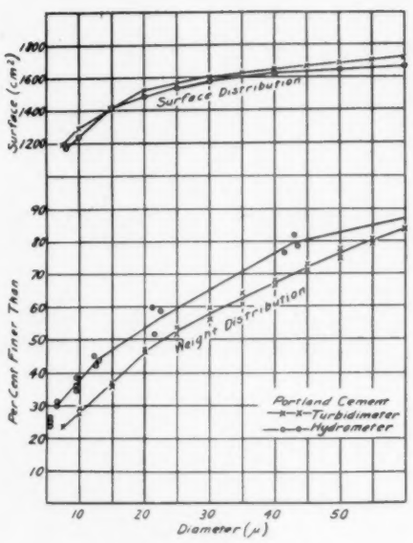


Fig. 1. Portland cement.

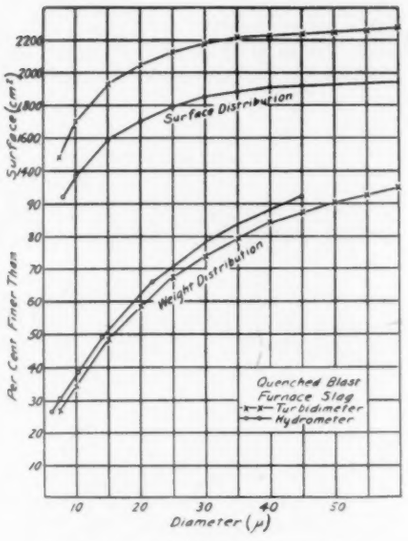


Fig. 2. Quenched blast-furnace slag.

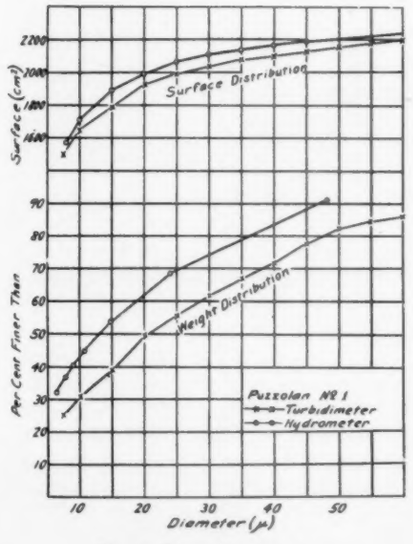


Fig. 3. Pozzuolan No. 1.

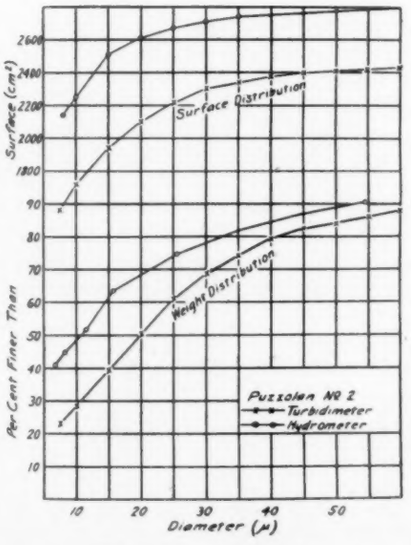


Fig. 4. Pozzuolan No. 2.

[4] R. N. Traxler and L. A. H. Baum, "Measurement of Particle Size Distribution by Optical Methods", *Proceedings*, Am. Soc. Testing Mats., vol. 35, Part II, p. 457 (1935).

[5] *Proceedings*, Am. Soc. Testing Mats., vol. 35, Part I, p. 777 (1935); also 1936 *Book of Tentative Standards*, p. 399.

Comparison of Two Methods on Portland-Pozzuolan Cements. — The testing of cement for Bonneville Dam affords an example of the differences encountered when two methods of particle-size measurement are used. The specifications call for a Portland-pozzuolan cement consisting of three parts by weight Portland cement and one part calcined pozzuolanic material. It was thought that the low opacity of the pozzuolanic ingredient would make a turbidimetric method unsatisfactory, and a hydrometer was specified instead. However, because of the time that could be saved in testing such a large number of samples by the more rapid turbidimetric method, a series of tests was made by L. A. Wagner with hydrometer and Wagner turbidimeter using the following materials:

Material	*Color*	*Density*
Portland cement	gray	3.22
Quenched blast-furnace slag	white	2.90
Pozzuolan No. 1	old rose	2.66
Pozzuolan No. 2	light pink	2.37

The procedure for making the hydrometer tests is given in the specifications for Portland-pozzuolan cement for Bonneville Dam and also in a paper presented at the Thirty-ninth Annual Meeting of the American Society for Testing Materials;[6] for the turbidimeter tests, the procedure is given in A.S.T.M. Method C 115-34 T.[5]

First, the particle gradations of the above ingredients were determined, the weight and surface distribution curves being shown in Figs. 1 to 4. Next, three mixtures having the following compositions were prepared and their densities were calculated from those determined on the ingredients.

Mixture	*Density*
3 parts Portland cement and 1 part quenched blast-furnace slag	3.13
3 parts Portland cement and 1 part pozzuolan No. 1	3.06
3 parts Portland cement and 1 part pozzuolan No. 2	2.95

Surface and weight distribution curves for each of the three mixtures were obtained for both methods of analysis in two ways: (1) the "calculated" curves were obtained by adding three quarters of the ordinates of the curves for cement to one quarter of the ordinates for the pozzuolanic materials; (2) the "observed" curves were obtained from tests of the actual mixtures. These curves are shown in Figs. 5 to 7.

It was pointed out that any evaluation of specific surface for a material uniform in chemical composition is arbitrary. In dealing with a mixture of two materials of different physical properties using a sedimentation method, serious complications arise which make the results for such materials even more questionable. The grading of the two ingredients is likely to vary considerably; therefore, the proportion of each in a given fraction can only be guessed at. Also, each fraction will have two sets of limiting diameters corresponding to the densities of the two ingredients. Since all calculations of specific surface are based upon the geometrical and physical relations of fractions of comparatively narrow limits, this uncertainty as to the composition of the individual fractions introduces an additional uncertainty into the analysis not encountered when a homogeneous material is used.

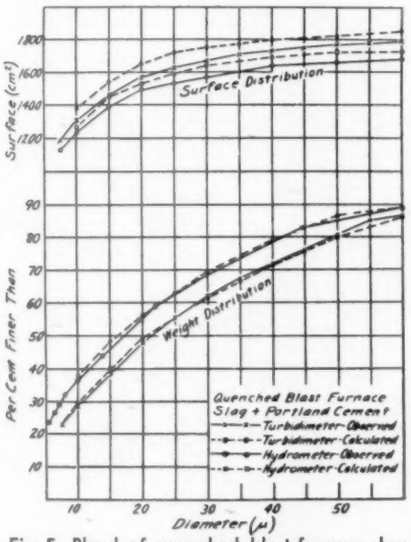


Fig. 5. Blend of quenched blast-furnace slag and Portland cement.

Using the usual assumptions, the following equation for the surface area of a fraction, the limits of which are set by the time of settling, applies for a two-component mixture:

$$S = \frac{6\,w_1}{\rho_1 D_1} + \frac{6\,w_2}{\rho_2 D_2},$$

where S = total surface area of the fraction,

w_1, w_2 = weight of each component in the fraction,

ρ_1, ρ_2 = density of each material, and

D_1, D_2 = "Stokes' diameter" of the particles of each material, the arithmetic mean of the limiting diameters being used.

With a turbidimeter the surface, S, may be measured by the opacity of the suspension, but before this can be converted into known units an integration of all the fractions must be made and the sum of the weights of the fractions equated to the known total weight of the sample. This summation is impossible unless the ratio w_1/w_2 for each fraction can be determined. From the composite density of the suspension as determined with the hydrometer the weight of the fraction $w_1 + w_2$ can be calculated, but the surface, S, could be computed only if the above ratio is known. For this latter no satisfactory method is known.

If the densities of the two ingredients of the mixture are the same, the above difficulty is not encountered. Even to approach a definite particle-size determination by any sedimentation method one must make the assumption that each ingredient has the density of the mixture. This is permissible, if the

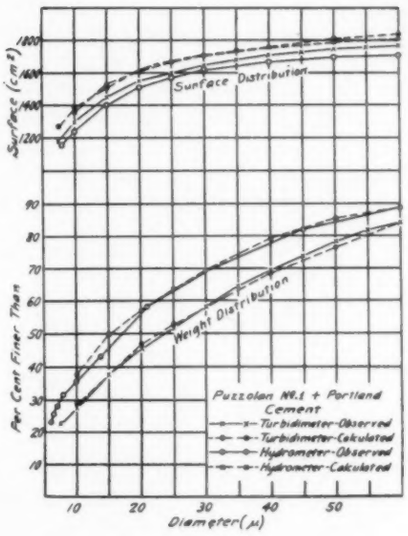


Fig. 6. Blend of Pozzuolan No. 1 and Portland cement.

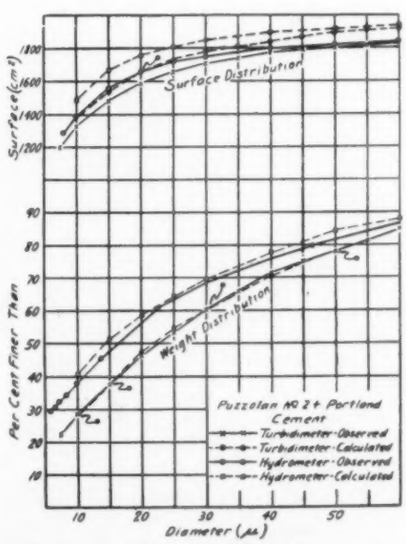


Fig. 7. Blend of Pozzuolan No. 2 and Portland cement.

[6] S. B. Biddle, Jr., and Alexander Klein, "A Hydrometer Method for Determining the Fineness of Portland-Puzzuolan Cements," *Proceedings*, Am. Soc. Testing Mats., vol. 35, Part II, p. 310 (1936).

densities of the two ingredients do not differ too widely. This was done in the tests on these pozzuolanic cements, which explains the difference between the observed and calculated values.

An examination of the curves for each separate ingredient reveals that the hydrometer invariably indicates a finer size distribution by weight than does the turbidimeter. However, the calculated specific surfaces are not always higher because particles less than 2.7μ were neglected in the calculations for the hydrometer method.

In comparing the "observed" and "calculated" weight distribution curves for the mixtures and for any one method, it will be seen (Figs. 5 to 7 inclusive) that there is good agreement. However, the "observed" specific surface is invariably lower than the corresponding "calculated" value by about 4 per cent. for the turbidimeter and about 4½ per cent. for the hydrometer. If the "calculated" values for either instrument are accepted as being the correct results, the degree of agreement between the "observed" and the "calculated" values becomes a measure of the suitability of the instrument for the analysis of such mixed materials. On this basis there is little choice between the two methods. However, there are three undesirable features of the proposed hydrometer method. First, it is time consuming, a single test taking 1½ hr. for readings alone. This is objectionable not only from the standpoint of economy but also because it may allow agglomeration of the particles to take place. Second, the hydrometer bulb is introduced into and withdrawn from the suspension eight times during the test, which inevitably results in considerable agitation of the suspension and interferes with the free fall of the finer particles. This pumping action probably accounts for the fact that the hydrometer indicates a finer grading by weight than the turbidimeter. Third, the hydrometer does not measure the density of the suspension at any definite level and, therefore, cannot correctly measure particle size.

To illustrate the third feature assume that a suspension is made of particles all of which are 10μ (40 g. cement in 800 g. kerosene), that the density of the kerosene is 0.810 and the density of the suspension is 0.840. As the particles settle the hydrometer readings must vary from 0.840 at the start to 0.810, when all the cement is below the lower end of the bulb. Since the distance from the 0.810 mark to the end of the bulb is about 28 cm., this would take approximately 1 hr. and the sample would have an apparent range in size from about 8 to 40u, or more. The only reason that the distribution curve for an actual cement approximates those obtained by other methods is that the hydrometer distorts every fraction.

The result of the tests shown here do not reveal any large discrepancies that could be ascribed to differences in the optical properties of the several ingredients used. The conclusion is that such errors in a turbidimetric determination are negligible, and the greater initial cost of the turbidimeter over the hydrometer will be more than compensated for by the time saved with the former instrument.

Conclusion.—In selecting a method of making particle-size determinations one should keep in mind that at present there is no method which will yield theoretically correct results. The values obtained are as arbitrary as the hardness numbers used in metals testing, and their usefulness is of much the same nature. That is, they must be interpreted in terms of the apparatus and method of calculation used. However, the approximate nature of the results does not detract from the value of the method, if it aids in producing a suitable and uniform product in an economical manner.

Pratical considerations should determine the choice of apparatus and method. General use of a particular method for the same or closely-related materials is an advantage, because this fact indicates that the results of this method have been correlated with the properties dependent upon fineness. Speed and ease of making determinations should not be overlooked, not only for economy, but also because it leads to efficiency when used for control purposes.

For different materials, different interpretations of observations are probably necessary. For any one class of materials it would be advantageous for all investigators to use the same interpretation of data. For example, in dealing with hydraulic cements, much confusion could be avoided if the computations of specific surface for all methods of securing data were standardized as follows:

1. Define particle size as Stokes' diameter.
2. Set the limits of all fractions at convenient, uniform sizes.[7]
3. Take the surface mean diameter of any fraction as the arithmetic mean of the limiting sizes.
4. Treat a blended cement as a homogeneous material.

Acknowledgments: Acknowledgment is made to L. A. Wagner, who obtained all test data on the Portland-pozzuolan cements, and P. H. Bates, who outlined the work and suggested several important changes and additions.

[7] Since A.S.T.M. Tentative Method C 115-34 T has been so widely accepted, it is suggested that the following fractions be used: 0 to 7.5, 7.5 to 10, 10 to 15, 15 to 20, 20 to 25, 25 to 30, 30 to 35, 35 to 40, 40 to 45, 45 to 50, 50 to 55, and 55 to 60u.

Survey Shows Narrower Roads Are Hazardous

Thousands of miles of roads, built in the days when there were less automobiles and when 30 mi. an hour was considered the standard touring speed, must be widened to protect the public from traffic accidents and fatalities. These roads, with surfacings only 18 or 20 feet wide, are inadequate for modern traffic composed of passenger cars and trucks travelling at higher speeds and are suitable only for light traffic.

Many states are effectively meeting this need for wider roads by constructing bituminous mat shoulders on the older narrow roads. By this method the road can be made any desired width at extremely low cost.

How great a factor narrow roads are in highway accidents and fatalities is difficult to determine, but according to one of the large insurance companies, driving off the roadway is the cause of 15 per cent. of the highway fatalities. Passing, cutting in, and speeding are also major causes of accidents. The hazards to the offending drivers, and to other drivers on the road, are increased by narrow highways, so that narrow roads are a contributing factor in possibly one-quarter or one-third of the accidents on rural highways.

In a recent survey of traffic, the U. S. Bureau of Public Roads recorded the movements of cars by motion picture cameras. By these studies it was found that drivers, fearing being pushed off the road, tend to hug the center line when being passed by another vehicle on a two-lane road.

The bureau concludes from its survey that "pavements of 18-ft. width are too narrow for modern passenger cars alone, or for modern mixed traffic. Pavements of 20-ft. width are reasonably adequate for light-traffic roads used infrequently by wide trucks, but are inadequate for heavy mixed traffic. Pavements of 22-ft. width are entirely adequate for modern mixed traffic."

P AND Q
PROFITABLE
New Products
SECTION

MERCHANDISING READY-MIXED CONCRETE*

By R. C. COLLINS
Philadelphia Retail Sales Manager, Warner Co.

ABOUT 35 years ago the Portland Cement Assn. was formed to "extend and improve" the use of concrete as a material of construction. The association undertook to educate architects, engineers and contractors to the true value and utility of concrete. For years, however, concrete as an accepted material with ever-increasing uses was not sold as a finished product. Not until the advent of the ready-mixed-concrete plant could such sales be made. The merchandising of ready-mixed concrete is therefore comparatively new, the experience of the oldest companies covering only about 15 or 16 years. The problem of the ready-mixed-concrete industry, however, is that of selling a new method and technique of manufacture and delivery of an accepted product, rather than that of introducing a new product.

Henry Ford once said that among the fundamental principles of business are: (1) to strive always for higher quality as well as lower costs; (2) to get the goods to the consumer in the most economical manner.

It was with these guiding principles in mind that the Warner Co., with which I am associated, approached the problems of merchandising ready-mixed concrete. We realized that unless we could offer a consistently better concrete of truly greater value than that previously available, there would be little chance of obtaining wide acceptance of our product.

After much engineering study and observation over a period of years the Warner Co. wholeheartedly adopted the central-mixing method of producing pre-mixed concrete. Subsequent references here to constant quality control, consistent uniformity of established mixes, service, etc. are based on our experience in producing and delivering approximately 2,000,000 cu. yd. of central-mixed concrete in the past seven years.

Having decided on the method of manufacture, the proper methods of merchandising were then considered. We realized that our first job of selling was with architects, engineers, contractors and public officials to secure their unreserved acceptance of the improved product. Clearly recognizing our responsibility to this group for our various claims, we employed an independent laboratory organization to maintain independent inspection and testing control over the production of this improved concrete. This independent laboratory certified the quality, grading and quantity of the ingredients and the water-cement ratio used in every cubic yard of concrete produced and delivered. This certification was indicated by signature on each ticket, and it created confidence in the minds of customers, thus supporting our sales campaign based on the quality guarantee of the product.

A bulletin stressing and illustrating the advantages of central-mixed concrete to both the purchaser and the owner was prepared and mailed each month to our customers. We increased our efforts with architects and engineers to have central-mixed concrete specified, or at least included, in specications as an alternate to job-mixed concrete. The real fun started when we had to sell the contractor who was accustomed to mixing concrete in the field and who wanted all the benefits of central-mixed concrete without paying for any of them.

In most cases the improved quality we offered meant little to the contractor, unless he could save money by using it. Since the concrete he had been making passed specifications, naturally he was not interested in the idea of paying more money for something else, even though it was better.

It is incorrect to state that by using ready-mixed concrete a better job will be secured than can be produced by a contractor who has the necessary knowledge, skill, equipment and organization to mix concrete properly in the field. The completed concrete job involves three operations: mixing, placing and curing. It is fair to state, however, that because of economic reasons, except on large jobs we do not often find the plant, equipment, and the technical operating forces, adequate to produce concrete comparable to ready-mixed concrete in its consistent, uniform quality. Furthermore, when the necessary equipment and trained men are available in the field, the cost of production is usually sufficiently high to make possible the sale of ready-mixed concrete at a normal profit.

It is acknowledged that people buy a better article only because they believe they will benefit to an extent which will be worth more to them than the added cost of the better article. Our job then became one of educating the contractor to pay a higher initial cost for the better article and of selling him the added benefits of using central-mixed concrete.

What are the benefits to the contractor who purchases ready-mixed concrete?

Are they worth more to him than they cost?

How can we, as merchandisers, drive home to the contractor these benefits, so that he is willing to pay the producer a profitable price?

What is a profitable price, and on what basis is it established?

How can we justify the price we have established, and can it be maintained?

These questions and many others must be answered by anyone engaged in the ready-mixed-concrete business, if he wishes to remain in business.

First let us consider the benefits to the purchaser of ready-mixed concrete:

Consistent uniformity is obtained by ready-mixed methods, when adequate facilities are available for the proper storage, grading and classification of the aggregates, for accurate weigh-batching, for regulation of temperature in cold weather, for control of the water-cement ratio, etc. Here, again, the Warner Co. feels that central-mixed methods are to be preferred, because their use makes possible quick adjustments in the proportions of the ingredients to compensate for any variation noted in the grading of the aggregates. A variation in the grading may be slight and entirely within the specification limits, but it can have a decided effect on the water-cement ratio necessary to maintain a given slump or consistency. The central-mixed operator has a final visual check of the concrete as it leaves the mixer and enters the delivery vehicle. The benefit to the contractor of the accurate check on all the ingredients is that the entire pour will be uniform in strength, density and appearance with reduced honeycombing, and safer removal of forms is permitted.

Greater plasticity is obtained by ready-mixed methods, due to the violent action of the initial mixing and the following mild agitation in the revolving drum *en route* to the job more completely hydrates and densifies the concrete into a homogeneous mass. The benefit to the contractor is in the

* Presented at 1938 Convention, National Ready-Mixed Concrete Assn., Cincinnati, O.

easier and more economical placement of the concrete and easier finishing, which saves time and money, and in the avoidance of "stand-by" lost time both of labor and equipment.

Larger pours are possible through the use of ready-mixed concrete where a plant of sufficient capacity is available. This is particularly true in congested districts, where job facilities would be limited, and applies on both small and large jobs. On a small job the plant cost would be excessive to provide the high yardage per hour normally supplied by a ready-mixed-concrete plant. Furthermore, a contractor can expand his business and work on several jobs simultaneously, without increased capital investment in mixers and equipment.

Reduced labor costs are effected by the contractor when he uses central-mixed concrete. He can start a pour at any hour of the day within reason and, due to the greater yardage obtained per hour, can complete the pour with little or no overtime. In winter this is particularly advantageous, as he eliminates the necessity of heating materials on the job, and can arrange his pour during the warmest part of the day.

The service given by the modern ready-mixed-concrete producer is of definite and proved value. To-day by utilizing ready-mixed concrete the contractor may be assured of a concrete of a guaranteed service or certified strength and quality. That statement applies to the ready-mixed-concrete industry as a whole, but we feel that such a guarantee can be made with more confidence in the case of central-mixed concrete. Servicing this product, that is, "getting the goods to the consumer in the most economical manner", however, involves both consumer and producer in a very practical coöperation. The servicing of concrete means servicing a highly specialized, bulky and perishable product, which for true economy must be moved on the basis of large tonnage and prompt unloading. Like time and tide, ready-mixed concrete by its very nature will not wait beyond certain limits of time that are known. When it has been mixed, then it needs to be placed. It cares nothing for red lights and stop signs, poor runways, broken skips, incomplete instructions or careless ordering. These factors must be cared for by the producer or the consumer, or by both working together.

Another phase of service which we as central-mixed-concrete producers render is the proper interpretation of specifications. In the past few years an ever-increasing percentage of work has been done under Federal or state specifications. These are frequently misleading, or at least possible of improper or dual interpretation. A well-organized ready-mixed-concrete producer has the necessary knowledge and personnel to discuss intelligently and to correctly interpret such specifications with the authorized job representative. I can say that in a number of cases in our experience our correct interpretation has saved the contractor from unreasonable interpretations by job representatives, and these have meant a real economy to the contractor.

Service is a greatly misused and abused term, but the importance we have given to it as a factor in our sales of central-mixed concrete has convinced the contractor of its real value to him. Our service men have shown him how the prompt unloading of our trucks, proper care in providing suitable roadways, close coöperation with our sales and shipping departments will pay him real dividends in lower placing costs on the job.

Finally, the purchase of ready-mixed concrete assures the contractor a predetermined, accurate cost per cubic yard of concrete. It reduces the risk of estimating errors. He knows that regardless of increases in the cost of labor or material from the time the estimate is figured until the job is completed the cost of ready-mixed concrete will be constant. It is acknowledged by most contractors that, when figuring a job, they always use the lowest estimated costs commensurate with reasonable safety, and allow little or nothing for contingencies. The estimate is prepared and submitted with a prayer that job costs will not exceed estimated costs. By purchasing ready-mixed concrete one of his prayers is answered, the risk of loss reduced, and greater peace of mind assured.

Such, in brief, are a few of the very real "buyer benefits" accruing to the purchaser of ready-mixed concrete. That these benefits are worth more to him than they cost him has been evidenced in the Warner Co. markets by the high percentage of contractors who continue to use central-mixed concrete on highly-competitive jobs. We aim to keep these facts constantly before the contractor, through bulletins and our company publication sent by mail, and through salesman-contacts. All these always stress "buyer benefits" rather than price. Regardless of all our efforts, however, price is continually a factor.

We have asked "What is a profitable price and how is it established"? In our case the list price of central-mixed concrete is based on the cost of the dry materials delivered to the job in truckload lots plus a fair estimate of the contractor's cost of plant handling and mixing on the job. To this figure a profit is added commensurate with the higher delivery cost of central-mixed concrete and the "buyer benefits".

On large jobs due recognition is given to economies that can be effected by carload purchases of dry materials and lower plant cost per cubic yard. A quantity discount from the list price is allowed. In Philadelphia these discounts are as follows:

On jobs up to 500 cu. yd. . . list price
On jobs from 501 to 2,000 cu. yd. . . . . 40c. off list
On jobs from 2001 to 4,000 cu. yd. . . . . 80c. off list

The fact that we have been able to maintain these list prices on about 90 per cent. of the jobs in a highly-competitive, low-volume market indicates to us that they are sound. The chief deviation from the list has been for highway-paving work, where batching and plant costs are low and the cubic yardage per day is high. To meet this situation it has been necessary on occasions to make some adjustment in prices. However, economy is effected for the producer in the case of ready-mixed-concrete deliveries to road jobs through the rapid unloading of the trucks. In practice this often tends to reduce the hauling cost below the average for all types of delivery.

We firmly believe that ready-mixed-concrete prices should always be kept well above the cost of material plus job-mixing costs. Why? In the first place, the "buyer benefits" already mentioned are of demonstrated real value to the contractor. Therefore, if the ready-mixed-concrete producer meets the dry-material plus job-mixing costs and, in addition, gives the many "buyer benefits", he is in effect cutting the price on the job. Such action usually forces the dry-material supplier in turn to cut his prices to offset the advantages of ready-mixed concrete, and in a short time the market is then demoralized and nobody profits. In the second place, the cost of delivery for ready-mixed concrete is higher than that for dry materials. If an average 4-mi. haul of dry materials can be made in 1 hr., our experience is that it will require 1½ hr. for a similar delivery of central-mixed concrete.

As to the maintenance of price in a given market, we are firmly of the opinion that the producer must make a decision between two sales policies: (1) To seek sales volume beyond his

(Continued on page 77)

PROFITABLE NEW PRODUCTS

Houses built with Jourdan units are photographed and reproduced on post-cards to stimulate sales among prospects. One of these is shown at the right.

By D. R. (Spec) COLLINS

BEATS DEPRESSION BY DIVERSIFICATION

WHEN the storm clouds of the depression started to form in 1930, instead of scuttling for the storm cellar the Jourdan Concrete Pipe Co. of Fresno, Cal., decided to stay out in the open and battle the elements. H. W. Chutter, manager of the Jourdan company, arrived at this decision—that of diversification—that may well be followed by other concrete men during the present period.

Instead of depending wholly on the pipe business for income, Mr. Chutter decided that 1930 was an opportune time to engage in the manufacture of concrete building products. One thing that influenced this decision was the availability, in the foothills of the San Joaquin Valley about 18 mi. from Fresno, of volcanic gravel pumice, which could be used as aggregate. Mr. Chutter felt that by the use of this aggregate his business could be expanded considerably. Inasmuch as concrete of this material weighs but 84 to 90 lb. per cu. ft. compared to 150 lb. for ordinary concrete, the resulting product could be shipped a considerable distance from the Jourdan plant.

Accordingly a Flam vibrating concrete-tile machine, cars and a mixer were purchased, and Mr. Chutter embarked on his new enterprise. Because he was a good salesman and because he knew the skepticism attached to any new product in the building-material field, Chutter's first move was to build his own house of his newly-made tiles, which, because of the nature of the aggregate, were called Pumitiles. This house served two purposes, and served them both well. First, it provided a practical workshop in which he could determine the sizes of units which might be most needed in residential construction. Secondly, it furnished an opportunity to experiment with mortar and various types of interior and exterior finishes, such as Portland-cement stucco and cement paint. Most important, however, the house evidenced Mr. Chutter's confidence in his own material and provided an excellent display to be used in future sales work.

The plant office, used as a demonstrator, resulted in the sale of eight jobs within three months of its erection.

As quickly as the house was put under way, Chutter started physical tests of his product. These consisted not only of the routine crushing and absorption tests so familiar to most concrete-products manufacturers but fire tests as well. Then, armed with the results of these tests, as fast as they were completed, together with technical information on sizes, weights, mortar and paint recommen-

Jourdan units were used in this structure erected for the California Forestry Dept. at Visalia.

dations, he started to sell. So well has this background of information been put together that there were few questions about the product that could not be answered readily. Sales were made almost immediately, and in the face of a diminishing construction market the Jourdan plant was more than able to carry on and show a profit. In fact, the Jourdan company and its products are known far beyond the confines of California for the aggressive manner in which they have been merchandised.

Mr. Chutter has employed photographs in selling probably to a greater extent than any other concrete-products manufacturer. Not only does he watch and photograph jobs during

Another of the Jourdan jobs.

their construction for the purpose of catching details that he may pass on to contractor customers, but commercial photographs are secured of the finished jobs. Postcards made of these photographs go out from the Jourdan offices in a steady stream to prospects located within an economical shipping distance.

The handling of these postcards is of special interest, for on the face of the card appears only a photograph of one of the beautiful houses or striking industrial buildings built of Pumitiles. The reverse side carries the name of the owner, his address, the year erected and a description of both the exterior and the interior finishes. Needless to say, this clever postcard follow-up has developed many prospects, and a further personal follow-up on the part of Chutter has built into actual jobs a good majority of the prospects developed in this way.

Thus, every job erected has become a silent salesman for the Jourdan company. In the spring of 1936 the offices of the company became too crowded and cramped for the conduct of their ever-growing business. An attractive new Pumitile office was planned by E. W. Peterson, a local architect, placed in construction, and completed by the middle of July. The exterior walls of the building are of 8-in. Pumitiles untreated except that colored mortar is used on two walls and plain mortar on the other two walls, so that the building could be used for demonstration purposes. The interior walls are painted directly on the Pumitiles with a cold-water cement paint.

July of 1936 was extremely hot in Fresno and with the temperature outside running from 95 to 105 deg. F. the temperature within the office was averaging from 80 to 85 deg. Although at that time Pumitile production was running about 5 per cent. over well-built frame stucco, the standard in the Valley, eight buildings were sold by using the office as a demonstration during the first three months of its occupancy.

While Mr. Chutter is extremely modest about his success, accrediting the material itself for most of his sales, those "in the know" in California place their finger on aggressive merchandising at a time when prospects looked extremely gloomy as the real secret.

New Blaw-Knox batching plant being installed by the Roanoke Ready Mix Corp., Roanoke, Va.

Merchandising (from page 75)

reasonable percentage of the available business, regardless of price, or (2) to seek a reasonable percentage of the available business at a profitable price.

We in Philadelphia decided on the latter policy, and our experience in the past few years has convinced us that we chose the right policy. We have held or increased our percentage of the available business within reasonable limits each year.

(1) By special effort to sell our ability to serve properly any job large or small.

PROFITABLE NEW PRODUCTS

Storage yard and concrete-block plant of the Diamond Interlachen Sand Co., Interlachen, Fla., which started operating shortly before the first of this year.

(2) By constant attention to all the details of service.

(3) By adding to our fleet of trucks the most modern type of agitating truck.

(4) By maintaining our trucks in spic-and-span condition all the time.

(5) By steadily improving the quality of our product through research and a study of our aggregates.

We have used the good offices of the Research Division of the National Sand & Gravel Assn. in coöperation with our independent testing engineer, and have made certain changes in the grading of our aggregates within the limits of governing specifications. The result has been an improvement in the workability of our concrete, which has been recognized and appreciated by contractors.

There is no mystery or royal road to success in the proper merchandising of premixed concrete. It requires an ordinary common-sense study of marketing conditions, and a sound sales policy, properly administered. It presents a wide variety of sales and delivery problems in various markets. What is successful in one market may be unsuccessful in another. Certain basic sales policies should, however, apply in all markets.

Loaded on flat-cars at the plant of the Jackson & Church Co., Saginaw, Mich., where it was manufactured, this 80-ft. hardening cylinder was shipped to Block & Brick, Inc., Detroit, Mich., sand-lime-brick maker, for installation. It was designed to withstand a working steam pressure of 148 lb. to comply with A.S.M.E. standards.

"It's a Pipe"

to Cash in on New Business if you are equipped and ready for it.

Convenient type of Crescent Bell-End Concrete Pipe Mold

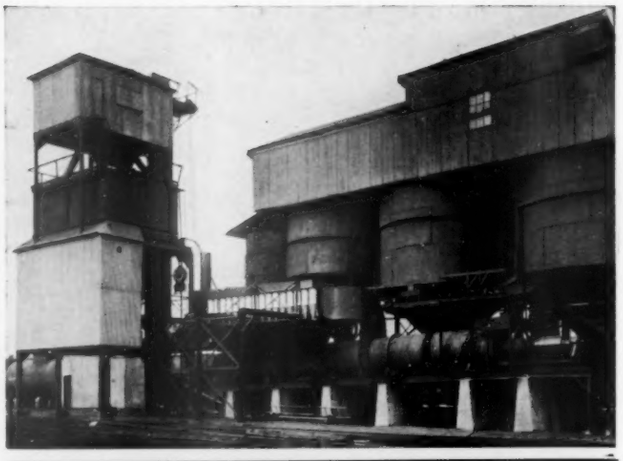
Now is the time to check up on your pipe forms, if you want to take advantage of the spring demand for pre-cast concrete pipe for sewers, culverts and drains. R & L Crescent Pipe Molds are available in all sizes, wall thicknesses and laying lengths—both the Bell-End and Tongue- and Groove-Molds, for standard or heavy duty construction.

R & L

Write for Bulletin of information

CONCRETE MACHINERY CO.
KENDALLVILLE, IND.

We also manufacture Joist Molds and Machines, Tile Forms and Vibrating Tables



WARREN ASPHALT PLANTS
HOT MIX —— COLD MIX
— OR —
COMBINATION UNIT FOR BOTH TYPES
CAPACITY DESIGN AND ARRANGEMENT TO MEET ANY REQUIREMENTS

Designed and Built
— By —
WARREN BROTHERS ROADS CO.
P. O. BOX 1869
Boston Massachusetts

PROVEN EARNING POWER

When DUNBRIK Manufacturers show sales of three million brick per year with production costs as low as $5.00 per thousand—others with selling price of 100% over cost—proves the great earning power of this line-production brick machine.

These enviable records are the result of producing a superior product,—lighter weight, greater strength, lower absorption, absolute accuracy, and with true corners. In addition, multiple sizes of standard brick (DUNSTONE) can be produced that permit hollow, insulated wall construction at cost level of frame.

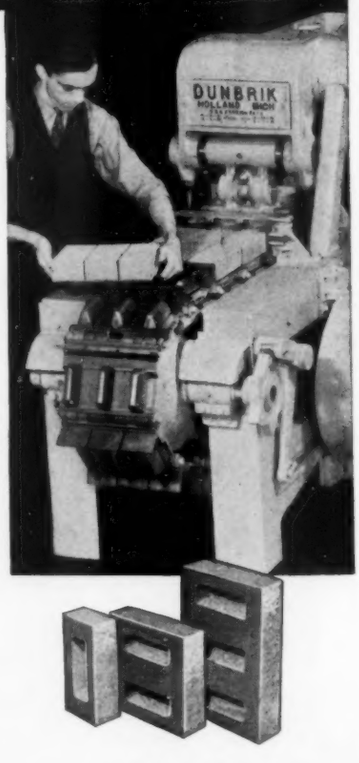
Write today for new book "4 Keys to Success" and learn about this wonderful machine, permitting large production with only one or two men and costing but a fraction of what would be required for other processes of equal capacity.

DUNTEX ROOF TILE MACHINE

With this machine you can dominate the vast roofing material market with a product unequalled in value, permanence, beauty and fire-safety. Your manufacturing costs are low, investment moderate, and selling prices offer attractive profit.

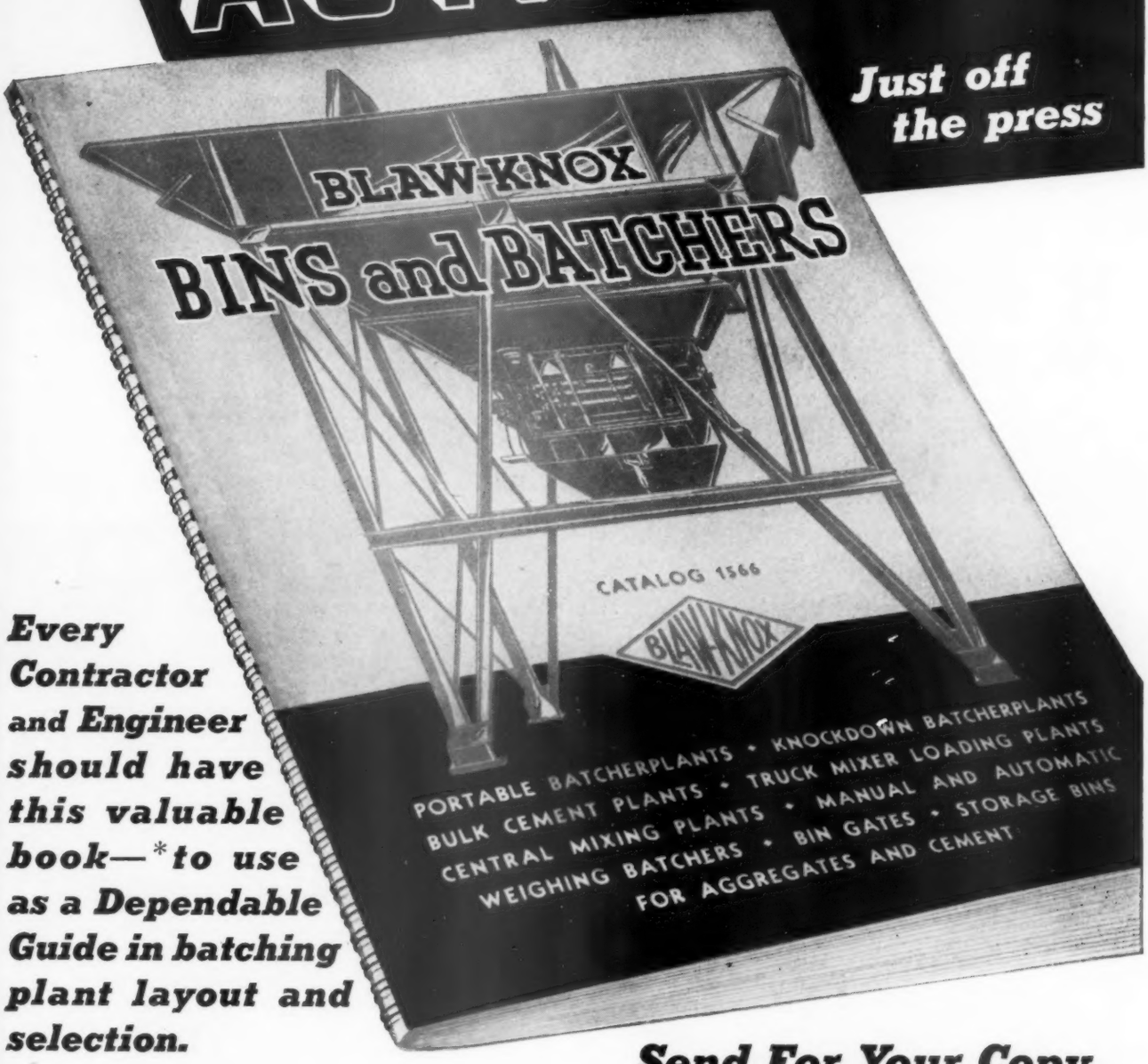
Send today for "DUNTEX Survey"

W. E. DUNN MFG. CO.
420 W. 24th St. Holland, Michigan



Here is Your AUTHORITY*

Just off the press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Every Contractor and Engineer should have this valuable book—*to use as a Dependable Guide in batching plant layout and selection.

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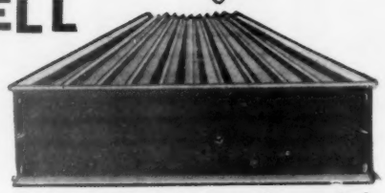
EASY TO MAKE EASY TO SELL Concrete Joists



R & L "Crescent" Ten-Gang Joist Mold

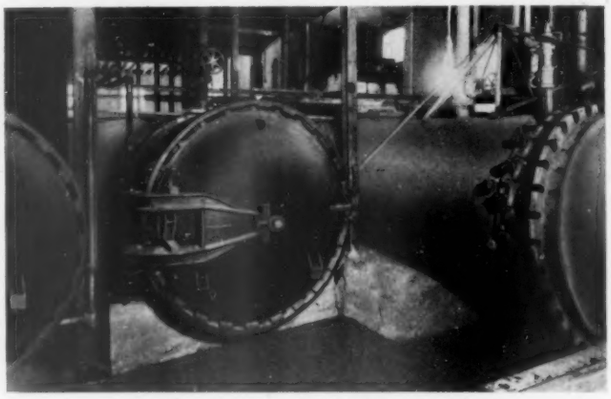
For you aggregate men who are looking for a profitable side line with a ready market . . . there is a big opportunity at small investment in the R & L Concrete Joist Machine. The building industry is "sold on" concrete joists . . . it's just a matter of taking orders for a proved product.

R & L *Write for Bulletin and full details*

CONCRETE MACHINERY CO.
KENDALLVILLE, IND.

We also manufacture Pipe Molds and Machines, Tile Forms and Vibrating Tables

FASTER CURING WITH STEAM



Quick Removal and Bolted Type Heads At Block & Brick, Inc., Detroit, Mich.

The hardening cylinders are built according to A. S. M. E. specifications, and are insurable with reliable companies. The standard cylinder is 6'-6" diameter by 58 foot long, holding 18 cars with a capacity little over twenty thousand brick, or one thousand 8"x8"x16" block. We make them any length desired with removable head at one or both ends.

The units are steamed for ten hours at 120-lb. pressure, either the sand-lime, cement, or cinder block has all expansion removed, eliminating cracked walls. They are then ready for immediate use upon removal, and in cold weather the products are in great demand.

JACKSON & CHURCH CO.
Manufacturers of
Sand-Lime Brick and Block Machinery
Saginaw, Michigan

The MULTIPLEX Hand-Operated Double Stripper.... *Makes TWO Blocks While Others Make ONE*

Investigate this high production, low-cost machine before you purchase any equipment for the manufacture of concrete building units. The Multiplex Double Stripper requires no motive power, yet will produce from 500 to 1,000 quality units per day. Produces waterproof block from a wet mix. Masons prefer blocks made on Multiplex machines because every side is finished and true to size. Adjustable for all sizes of random ashlar work as well as other sizes and style units, and changes are quickly made.

Thousands of plants, even those with outputs of 100,000 annually, have built up a reputation and a sound business with Multiplex Hand Strippers. Investigate this machine today!

MULTIPLEX CONCRETE MACHINERY CO.
ELMORE, OHIO

QUINN PIPE FORMS

HAND or WET PROCESS

Make concrete pipe on the job with Quinn Concrete Pipe Forms. Get complete information on prices and special construction features of Quinn Forms. Give us size of job for estimate on your pipe form needs.

HEAVY DUTY

Built for more years of service—sizes for any diameter pipe from 12 to 84 inches—any length—tongue and groove or bell end.

MEDIUM DUTY

Makes same sizes pipe as "Heavy Duty" but built to meet demand for lower cost equipment to produce uniform quality in smaller amounts.

Also manufacturers of concrete pipe machines for making pipe by machine process.

QUINN WIRE & IRON WORKS 1627 12 St. Boone, Iowa

Advertise your wants and surplus equipment in

PIT and QUARRY

PROFITABLE NEW PRODUCTS

your best bet!

CALCIUM CHLORIDE STABILIZED MIXTURE

Utilizes THE MATERIALS YOU HAVE ON HAND

The production of ready-mixed stabilized road material is the aggregate producer's best bet for added profits in 1938 and the years to come.

In awarding contracts for 185 miles of stabilized roads to be constructed this spring, the Michigan State Highway Department stipulated that all of the 232,709 cubic yards of stabilized material required must be *plant-mixed.* To fill their 1938 maintenance requirements, Michigan contracted for an additional 302,560 cubic yards of *plant-mixed* calcium chloride stabilized mixture. The demand for plant-mixed material is strong, too, in Illinois, Indiana, Minnesota, Ohio, and is increasing rapidly in other states.

Here's a market to your liking — a profitable market that you can cut into on short notice. Most pit and quarry owners have the greater part of necessary equipment on hand. Many have waste heaps of pit over-burden and washed-out sand, silt and clay which they can turn back into profit by mixing in proper proportions with graded aggregates.

Your state, county, township and city officials will tell you they want ready-mixed calcium chloride stabilized road materials. Ask them. Then get into the business now, this spring, and reap the profitable rewards in supplying this road necessity. Any of the firms listed below will gladly furnish free information and advise you the easiest way to take advantage of this opportunity.

Above: A typical mixing plant

Below: Delivering stabilized mix on roadway

CALCIUM CHLORIDE ASSOCIATION

The Columbia Alkali Corporation • Barberton, Ohio
The Dow Chemical Company • Midland, Michigan
Michigan Alkali Co. • 60 E. 42nd St., New York City
Solvay Sales Corp. • 40 Rector St., New York City

CALCIUM CHLORIDE

FOR STABILIZING ROAD SURFACES

KENT B. DIEHL
President
Gulf Portland Cement Co.
Houston, Tex.

MEN · OF · THE · INDUSTRY

Head of the Gulf Portland Cement Co., whose new plant is nearing completion at Houston, Tex., Mr. Diehl is also an accomplished musician, having been a member of the famed Sousa's Band for two years. He entered the cement field in 1926 as a special engineer for the Ash Grove Lime & Portland Cement Co., later becoming director of sales of special cements. In 1930 he joined the Dewey Portland Cement Co. in a similar capacity, leaving in October, 1936 to form the Gulf concern. After finishing his college course in civil engineering in 1922 he worked for the Ford Motor Co. for a number of years. He is 41 years old, a native of Bowling Green, O.

Trade Literature

Binks Spray Nozzles. 24 p. Binks Mfg. Co., Chicago, Ill.

The Multi-Vent Brick System. (folder) Multi-Vent Brick & Constructions, Ltd., U. S. representative: F. H. Hedinger, 303 Lexington Ave., New York, N. Y.

Gar Wood Hoists and Dump Bodies. (series of folders) Gar Wood Industries, Inc., Detroit, Mich.

Anaconda Varnished-Cambric Cable. 36 p. Anaconda Wire & Cable Co., New York, N. Y.

Kaminex Safety Plaster. 12 p. Safety Plaster Sales Corp., Passaic, N. J.

The Bradley Hercules Mill. 16 p. Bradley Pulverizer Co., Allentown, Pa.

French & Hecht Air-Tired Wheelbarrow Wheels. 4 p. French & Hecht, Davenport, Ia.

Faster Power. (tractors, scrapers, etc.) 40 p. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

The General Gives You More! (excavating equipment) 6 p. General Excavator Co., Marion, O.

Convertible Diesel and Gas Engines. 6 p. Fairbanks-Morse & Co., Chicago, Ill.

Consolidated Rebuilt Bearings. 16 p. Consolidated Bearings Co., East Orange, N. J.

Ransome Truck Mixers and Agitators. 24 p. Ransome Concrete Machinery Co., Dunellen, N. J.

Amsco Rivetless Lip Dredge Buckets. 4 p. American Manganese Steel division, American Brake Shoe & Fdry. Co., Oakland, Cal.

Change the Speed with This Variable Reducer Transmission. 12 p. Stephens-Adamson Mfg. Co., Aurora, Ill.

Dempster Dumpster. 28 p. Dempster Bros., Inc., Knoxville, Tenn.

New and Used Equipment List. 32 p. R. C. Stanhope, Inc., New York, N. Y.

ReflectroStrip (reflecting signal buttons). Aeroil Burner Co., West New York, N. J.

P&H Multi-Service Crawler Hoist. 6 p. Harnischfeger Corp., Milwaukee, Wis.

Glaze-Crete . . . A New Discovery in Concrete Products. 8 p. Glaze-Crete Corp., Pittsburgh, Pa.

Spencer Drill-Vac (dust-control system for rock drills) 8 p. Spencer Turbine Co., Hartford, Conn.

CMC Construction Equipment. 32 p. Construction Machinery Co., Waterloo, Ia.

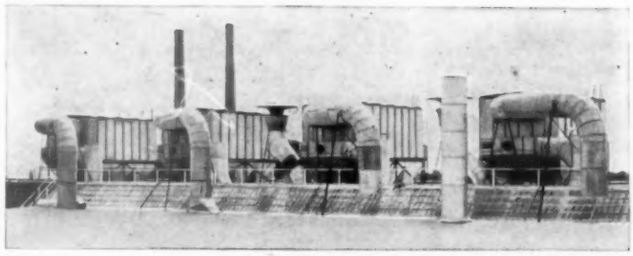
Foreign Competition Lowers Lehigh's Net

J. S. Young, president of the Lehigh Portland Cement Co., in his annual report says: "Since the company's production and shipments in 1937 were approximately the same as in 1936, the increase in cost can be attributed mainly to the higher level of wage rates. The shrinkage in average mill net is the direct result of drastic reductions in price along the Atlantic and Gulf coasts to meet foreign competition. The company's average wage rates during 1937 were 137 per cent. of the 1926 average and prices during 1937 were 87 per cent. of the 1926 level."

DRACCO DUST COLLECTORS will REDUCE REPAIRS and IMPROVE HEALTH STANDARDS

DUST always costs money — even in limited amounts. DUST works its way into your equipment and REDUCES its life and INCREASES the cost of repairs. Health standards are also improved when DUST is controlled. If you have Dust we suggest that DRACCO Engineers study your problem. They have over 20 years of practical experience in solving Dust problems of every description. Remember, — Dust costs you money in MANY ways—and the sooner it is eliminated, the better.

Write for Bulletin No. 302



A Battery of FOUR DRACCO Dust Collectors

Write for Bulletin No. 302

• DRACCO CORPORATION •

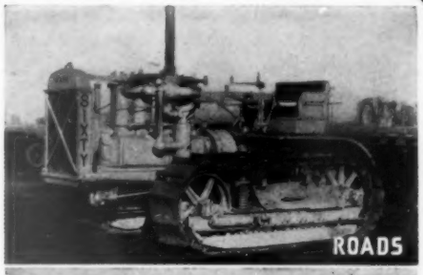
4077 E. 116th St., Cleveland, Ohio • New York Office, 130 W. 42nd St.

PNEUMATIC CONVEYORS • DUST COLLECTORS

GREDAG

LUBRICATION reduces **EQUIPMENT DEPRECIATION**

THE ORIGINAL ELECTRIC FURNACE GRAPHITE GREASE



Machinery used out-of-doors must be protected from wear due not only to shock loading and bearing pressures, but also from "break-down" of oil film resulting from weather conditions. GREDAG provides a durable graphite grease film that resists effects of cold, heat and dust. It has proved its worth by thirty years' use in road, quarry and mine machinery applications.

Write for booklet covering outdoor lubrication.

THE GREDAG CORP.

NIAGARA FALLS N. Y.

Personal Mention

LEE S. TRAINOR, construction engineer with the National Lime Assn., recently suffered a stroke of paralysis. Although he has not recovered the use of his left arm and leg, his general condition has improved. He is now under the care of Mrs. Trainor and a practical nurse at his home in Braddock Heights, Md. Anyone caring to write to Mr. Trainor can reach him at Box 107-A, Route 5, Frederick, Md.

NORMAN HOUGH has gone to New Orleans, La., where for several months he will be engaged in promotional work among architects, contractors, brick-masons, etc., for Jahncke Service, Inc., who a short time ago installed a Brooks-Taylor lime-putty plant. Mr. Hough recently completed a similar engagement with the Richter Concrete Corp. of Cincinnati, O., following the erection of a lime-putty plant in 1937.

WALTER KRONING has purchased the St. Charles concrete-block plant at St. Charles, Minn.

B. E. MANLEY, assistant secretary of the Hawkeye Portland Cement Co., Des Moines, Ia., has been named acting general manager, following the death of C. B. CONDON.

H. W. CHUTTER, secretary and manager of the Jourdan Concrete Pipe Co., Fresno, Cal., was elected president of the American Concrete Pipe Assn. at the concluding session of the annual convention of that organization in San Antonio, Tex. He has held the office of president of the California Assn. of Concrete Pipe Manufacturers since 1933.

FAY BRISTOL is reported to be erecting a lime-manufacturing plant in Miller Gulch, near Rogue River, Ore.

M. E. CROSBY has returned to his former position as chief engineer of the Burrell Engineering & Construction Co., Chicago, Ill.

R. A. GEZELIUS, formerly associate metallurgist of the Naval Research laboratory, Washington, D. C., has been engaged as metallurgist by the Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

NATHAN G. KIERNS, store-keeper at the Bonner Springs, Kan., plant of the Lone Star Cement Corp., has been transferred to the company's Kansas City office. He has been succeeded by WALTER COMPTON of the Bonner Springs office staff.

H. C. HUNT has been elected a director of the Pacific Portland Cement Co., to fill the vacancy caused by the death of FRED T. ELSEY. J. A. MCCARTHY, vice-president, has been empowered by the board of directors to act as chief executive of the company pending the return to office of ROBERT B. HENDERSON, president, who has been ill for some time.

FRANK A. LEE has been appointed assistant chemist of the Gulf Portland Cement Co., Houston, Tex. Mr. Lee was formerly connected with cement companies in Texas and Canada.

THEODORE HOFLITCH has sold the business of the Hoflitch Gravel Co., Albany, Ore., to DENT F. STEWART.

PERFORATED METAL SCREENS
FOR SAND, GRAVEL STONE, ETC.
Manufactured exactly to your specifications.
Any size or style screen, in thickness of steel wanted with any size perforation desired.
We can promptly duplicate your present screens at lowest prices.
Prompt Shipment
CHICAGO PERFORATING CO.
2435 W. 24TH PLACE CHICAGO, ILL.
Telephone CANAL 1459

PHILIP L. LEIDY and GEORGE RICHARDSON were recently elected secretary and treasurer respectively of the National Portland Cement Co. The latter, with the company since 1931, succeeds the late JOHN D. SHIBE.

R. R. LITEHISER, for the last eight years chief engineer of tests of the Ohio State highway department, has resigned to become director of engineering of the New York State Crushed Stone Assn. He will be located at Albany, N. Y.

B. F. DEVINE, Chain Belt Co., Milwaukee, was re-elected chairman of the Mixer Manufacturers' Bureau at the annual meeting in Cleveland during the Road Show. The bureau is affiliated with the Associated General Contractors of America, Inc.

J. W. CLEVELAND, formerly city engineer of Evanston, Ill., has resigned to become connected with the sales department of the Universal Atlas Cement Co., Chicago, Ill.

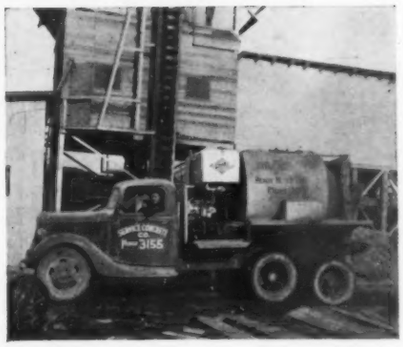
G. S. Parker, superintendent of the Davenport, Ia., plant of the Dewey Portland Cement Co., has been confined to a Davenport hospital following a major operation.

M. J. MOHAN, president of the Majestic Building Materials Corp., Overland, Mo., a St. Louis suburb, attended the recent concrete convention at Chicago. Mr. Mohan is planning to spend $20,000 for improvements at his concrete-products plant including the latest type Besser stripper.

DENN M. BURGESS, formerly domestic sales manager, has been made eastern sales manager of R. G. Le Tourneau, Inc., Peoria, Ill., and Stockton, Cal. J. W. LE TOURNEAU, general sales manager since the founding of the Le Tourneau organization, now occupies the position of general manager.

MARK BEEMAN has been made executive secretary of the Concrete Reinforcing Steel Institute, succeeding the late Richard W. Johnson. Mr. Beeman formerly served as secretary of the organization and later had charge of the Washington, D. C., office of the Portland Cement Assn.

OTHO M. GRAVES, president, General Crushed Stone Co., Easton, Pa., has been elected a member of the board of directors of the National Assn. of Manufacturers.



At the new ready-mixed-concrete plant of the Service Concrete Co., Muncie, Ind., concrete is delivered by this Blaw-Knox mixer mounted on a Ford V8 truck converted to four-rear-wheel drive by the Thornton Tandem Co. According to Supt. Heady, the truck can get into mud up to the axles without getting stuck.

C. W. Brown, chief engineer of the Missouri highway department, has been elected president of the Mississippi Valley Conference of State Highway Departments, succeeding M. R. Keefe, chief engineer of the Indiana highway commission. A. C. Tilley, Nebraska highway engineer, was chosen secretary.

J. Catucci, Oakland, Cal., has begun the erection of a rock-crushing plant to cost about $30,000, exclusive of equipment.

Louis Schirm, president of the Grand Canyon Lime & Cement Co. and the Mission Lime Products Co., both of Los Angeles, Cal., passed away at his home in Los Angeles the first week in March. Mr. Schirm was also a director of the Southwestern Portland Cement Co. and the Oregon Portland Cement Co.

M. M. Hutchinson, secretary of the Carolina Lime & Phosphate Co., Charleston, S. C., passed away recently. He was 46 years old.

A. Clas, vice-president of the Garrett Construction Co., contractor and producer of crushed stone and ready-mixed concrete at Springfield, Mo., died in February.

Oreste Formigli, 72, president of the Formigli Architectural Stone Co., and one of the pioneer artificial stone manufacturers of the country, died suddenly of a heart attack at his home in Williamstown Junction, N. J.

Fred L. Wear, vice-president of the Santa Clara Valley Sand & Gravel Producers' Assn., and a former executive of the Atlas-Olympia Co., died recently at his home in San Jose, Cal.

J. E. Triganne, sales manager of Asbestos Corp., Ltd., Thetford Mines, Quebec, died March 5. He was one of the best known figures in the asbestos industry, on this continent, with which he had been connected since 1910.

Maurice A. Long, 62, founder and president of the M. A. Long Co., nationally-known engineering and construction firm, of Baltimore, Md., died at his home in Baltimore on Feb. 27. He was also vice-president of the Maryland Slag Co.

Confronted with a diversion of more than $4,000,000 of gasoline tax from the highway fund to other purposes during the last four years, the North Carolina Petroleum Industries Committee is organizing local committees in every county to fight against continuation of this practice. A special effort is being made to contact candidates for the state legislature and secure before the election their pledge to oppose gas-tax diversion.

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Traffic News Digest

Recent I. C. C. Decisions

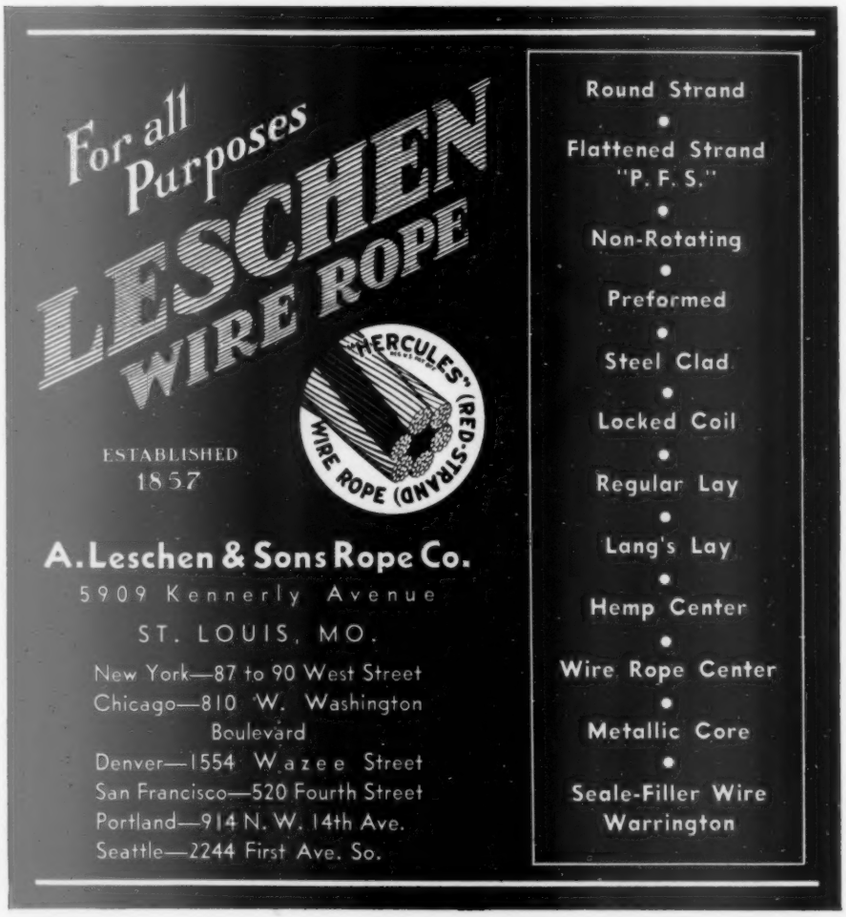
Freight-Rate Increases—The amount of the freight-rate increases granted in Ex Parte No. 123 are now generally known as the amounts of these increases were front page news in the daily press at the time the decision was rendered on March 8. The new rates will probably become effective not later than the early part of April. The decision in this case in effect repeals the increases allowed in Ex Parte No. 115 then adds 10 per cent. to the rates in effect before the decision was made in that case. There are certain exceptions but the only ones directly effecting the non-metallic minerals industry is that no increase is allowed on bituminous coal and that an increase of 10c per ton is allowed on anthracite coal. As an example of the speed with which this case was handled the case was decided on Mar. 8 and a small number of mimeographed copies of the decision were printed and given to the public on the same day. This is the first time that such procedure was used as the decision is generally given to the government printing office and not made public until several days after the decision is reached. The case was submitted to the Commission on Feb. 9 which establishes a record in handling a major rate proceeding. In the case of coal it was found that the large coal carrying roads were not in need of additional revenue. In justification for the increases granted the Commission pointed out that the pay roll increases from 1916 to 1936 chargeable to operating expenses amounted to 24.34 per cent. that other operating expenses had increased 24.03 per cent. and that taxes had increased 100.37 per cent. while during the same period operating revenues had increased only 11.31 per cent. Contained in the conclusions of the Commission are the following words:

"We are not able to find that the imposition of a horizontal increase in rates and charges of 15 per cent. (subject to certain limitations attached to the proposal) upon all the present going rates and charges will result in a body of rates and charges which are on the whole, or in any region or district, just and reasonable. We conclude that the increases made upon cotton effective July 31, 1937; those made effective early in the year 1937, as described in our report in General Commodity Rate Increases, 1937, supra, at page 673 thereof; those distinctly approved in our report in the case last cited, and made effective in November, 1937; and those which became effective on and before December 20, 1937, as the result of our order in the case last cited suspending outstanding orders to enable the publication and filing of increases on other commodities as prayed all should be considered as part and parcel of the matter we are now considering. These increases were permitted because of a general financial, economic, and traffic situation which is one with that now prevalent, modified only in the degree of its intensity and by the interjection of some new elements and the elimination of others. The amount of added revenue realized by increases made effective during the progress of the proceeding last cited, or directly dependent upon the decision therein, was very substantial. In the case of bituminous coal the increase aggregated between 4 and 5 per cent. and certain rates exceeded 10 per cent. In this proceeding, which involves revenues generally and touches all commodities, it is reasonable and just that the contributions to revenues already made in such manner should be recognized, and it would be neither just nor reasonable to pyramid percentage increases thereon equal to the percentages imposed upon commodities which were not so increased. To do so would subject such doubly-increased commodities to an undue proportion of the total transportation burden, and subject those particular descriptions of traffic to undue and unreasonable prejudice and disadvantage as compared with all other commodities.

"In order that the revenues found not to be adequate may be made so, so far as is possible, it is just and reasonable that the body of existing rates and charges shall be increased. In determining the amounts whereby rates are inadequate, it is necessary to consider the effect on the movement of traffic of the rates as they are and as they may be increased. It is requisite for us to give weight to the conditions which prevail in the several industries of the country and to the respective general and comparative levels in market value of the various classes and kinds of commodities affected by the proposal under investigation. Giving due weight to the facts shown we conclude that it would be unjust and unreasonable to impose upon certain recognized groups of commodities, namely, products of agriculture, products of forests, and certain products of mines to the extent hereinafter indicated, the same full basis of increase in rates as upon the remaining commodities, but that a lesser amount of increase is just and reasonable to be applied upon such commodities.

"We therefore find and conclude that the proposals before us have not been justified as a whole, but have been justified to the following extent.

"All existing rates and charges, including those for accessorial services other than protective service against heat or cold, upon the date of this decision, including those found or prescribed by us as reasonable and not yet effective, may be increased and as increased may be maintained (subject to application of the rule of fractions suggested upon the hearing) by 10 per cent., except the rates on products of agriculture other than tropical fruits; except the rates on animals and products and the products thereof and articles taking the same rates, horses and mules not being included in this exception; and except lumber, shingles, and lath, and articles taking lumber rates; and except the rates on cottonseed oil and vegetable oils, n.o.s., other than linseed oil; as to all of which excepted groups of commodities the increase in rates may be 5 per cent.; and except anthracite, which may be increased 10c. per ton of 2,000 lb.; and except bituminous coal, lignite, coke, and iron ore, which commodities justly and reasonably should bear no further increases than those already imposed pursuant to authority granted in the case last cited; all import rates may be increased 10 per cent., but not to exceed the contemporaneous domestic rates increased as herein provided. But in making such increases, all effective increases accomplished under the authority of the decision last cited, or in the transcontinental rates which were increased in connection therewith as before recited, and in cotton rates and in those on other commodities effective early in 1937, as above described, shall be taken into account and considered as part of the increases here authorized, so that the above mentioned percentage increases shall not be made cumulative thereon. The increases authorized may not reasonably exceed the



specific maxima originally proposed by the applicants to be applied upon lumber, sugar, fruits, and vegetables. Such rates and charges, as those upon fresh milk and cream, and those for protective service, which applicants in their petition or on the hearing disclaimed intention to increase, are not included within this authorization and increases on them are found to have been justified. As increased as above specified, to the extent indicated, but only to that extent, the resulting general basis of rates and charges of the carriers described will be just and reasonable".

Crushed Stone—The Commission has found the interstate rates on crushed stone from Bowmansville, N. Y., to destinations in western New York and Pennsylvania and eastern Ohio unreasonable or joint-line hauls to the extent they may exceed by more than 10c. a net ton those from Buffalo to the same destinations but not to exceed the so-called West Penn scale prescribed in 104 ICC 717. To these rates may be added the general-rate increases authorized in 223 ICC 657. Rates for single-line hauls were found to be not unreasonable or otherwise unlawful. New rates are to be made effective not later than April 15. I. C. C. No. 27,714 Buffalo Crushed Stone Co., *v.* Arcade and Attica *et al.*

Lime—In Ohio Lime Manufacturers *v.* Pennsylvania reported in 214 I. C. C. 417 the Commission prescribed rates on lime applicable on minima of 15 and 25 tons and in the case of fluxing lime a third minima of 35 tons. A scale of rates was prescribed applying on the 15-ton minimum with rates on the 25 minimum based on 80 per cent. of the 15-ton rates and rates on the 35 ton minimum based on the 70 per cent. of the 15-ton rates. The Commission has now found that the rate on chemical lime from Eagle Mountain, Va., to Charleston and South Charleston, W. Va., not unreasonable in so far as they applied to minima of 15 and 25 tons but unreasonable to the extent that the carrier failed to establish the 70 per cent. rate applicable on a minimum of 35 tons. Reparation has been awarded on shipments made on and after April 3, 1936 on which the charges were higher than charges which would have accrued under the findings in this proceeding. I.C.C. Docket No. 27,469 Virginia Lime Products Co., *v.* C. & O.

Cement—Examiner D. T. Copenhafer recommends that the Commission find that the rates prescribed by the Pennsylvania Commission on cement from Neville Island, Pa., to destinations in the Pittsburgh, Pa., metropolitan area do not result in undue or unreasonable preference of prejudice as between persons or localities in intrastate commerce on the one hand and on interstate commerce on the other, or unjust discrimination against interstate commerce in violation of section 13. The Pennsylvania Commission has prescribed a scale of rates for use in the Pittsburgh area beginning at 3c. for 5 miles and ending with 7½c. for 50 miles. The cement scale for interstate movement prescribed by the Interstate Commerce Commission in Docket No. 12,710 begins with a rate of 6½c. for 5 miles and provides for a rate of 8c. for 50 miles. The examiner points out that if the rates were placed on the basis of the interstate scale the amount of business that would be lost to trucks would more than offset the estimated loss of $45,273.60 which the carriers claim is the difference in revenue which would accrue by using the interstate scale. He says that no evidence was introduced to prove that shippers outside the Pittsburgh area were losing business on account of the low basis of rates in effect from Neville Island and that the fact that intrastate rates might be relatively lower than interstate rates did not in itself constitute a violation of law. I. C. C. Docket No. 27, 768 Cement, Neville Island and Universal, Pa. to Pittsburgh, Pa.

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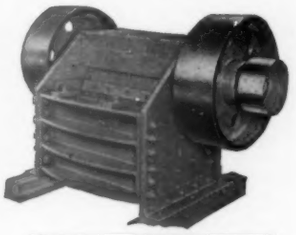

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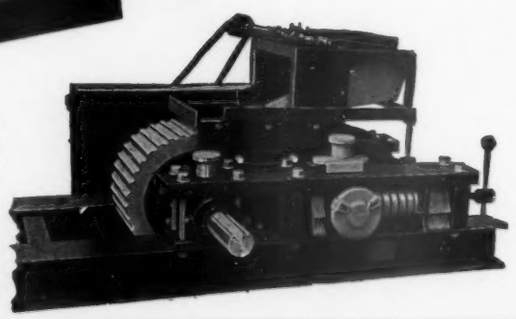

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Sand—Examiner Burton Fuller recommends that the Commission find the rates on industrial sand from Selkirk, N. Y., to Royersford, Hamburg and Middletown, Pa., prior to July 1, 1935 not unreasonable and that they dismiss the complaint in I. C. C. Docket No. 27,803 Floyd-Wells Co. *v.* NYC *et al.*, and sub Nos. 1 and 2 Berks Foundry & Mfg. Co. *v.* Same and Wincrot Stove Works *v.* Same.

New Complaints Filed

Pulverized Limestone and Whiting—The Commission has reopened a number of cases dealing with the rates on finely-ground or pulverized limestone which is used as whiting and whiting substitutes and has combined these cases with a number of complaints which have been filed in Docket No. 27,921 and sub numbers asking for new rates on whiting from Camden, N. J., to various destinations. Cases which have been opened only insofar as they relate to rates on pulverized limestone are No. 27,612, No. 25,220; No. 24,757 and No. 24,432 and sub numbers. Complaints which have been filed and entered by the Commission as sub numbers to Docket No. 27,921 since those recorded in the last issue of PIT AND QUARRY are: Sub No. 11, Whittaker, Clark & Daniels, Inc., New York, N. Y., *v.* Pennsylvania, Reading-Seashore Lines involving the rates on whiting from Camden, N. J., to New Haven, Conn.; Sub No. 12, Goodyear Rubber Co., Inc., Middletown, Conn., *v.* Same covering rates to Middletown, Conn.; Sub. No. 13, American Waterproofing Co., Inc., Cincinnati, O., covering rates to Cincinnati; Sub. No. 14, Ralph L. Fuller Associates Co., Cleveland, O., covering rates to Cleveland, and Sub. No. 15, Tamms Silica Co., Inc., Chicago, Ill., covering rates to Chicago and Tamms, Ill. These complaints were all filed by George A. Duffy, 491 Bourse Bldg., Philadelphia, Pa., and all ask for new rates and reparation on an alleged violation of section 1. The contention in all of these complaints is that the rates on whiting are higher than the rates on pulverized limestone and that these materials are competitive.

Sand and Gravel—The rates on sand and gravel from LaGrange and Reading, Mo., to Gladstone, Colmar, and Stillwell, Ill., applied on shipments made during 1934, 1935 and 1937 are alleged unreasonable and an order authorizing and allowing refund and waiver of charges is requested in a complaint filed by Lawrence W. Moore, City Bank Bldg., Omaha, Neb., in I. C. C. Docket No. 27,952 sub No. 1 Missouri Gravel Co., LaGrange, Mo., *et al v.* C. B. & Q.

NEW CORPORATIONS

KALAMAZOO CONCRETE PIPE CO., Kalamazoo, Mich., 30,000 shares $1 par value common stock. Paid-in capital $14,801. Incorporators: R. A. Beers, Edwin G. Gemrich, Harold A. White.

EAST WOONSOCKET TRAP ROCK CO., INC., Woonsocket, R. I. Capital 200 shares no-par-value common stock. Incorporators: Frederick Pelletier, Harriet A. Creech, Sidney Silverstein.

MORGAN GRANITE CO., Greensboro, N. C. Authorized capital $25,000. Incorporators: Homer Morgan, Cottie Morgan, Lottie Morgan.

CEDARVILLE DOLOMITE PRODUCTS, INC., Cedarville, O. Incorporators: Charles P. Elgin, Mary Elgin, Ralph E. Cummings.

GENERAL MATERIALS CO., St. Petersburg, Fla. (ready mixed concrete) A. N. Manson, president; Claude Hayden, vice-president; R. W. Smith, treasurer; J. A. Benton, secretary.

Occupational Diseases and the Law

"Bad Air" in Mine

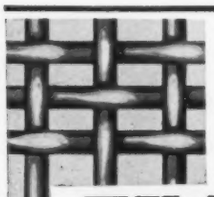
Black Mountain Corp. v. Lucas, Kentucky Court of Appeals, decided January 25, 1938. The issue in this case was whether the evidence sustained the board's conclusion and finding of fact in a case involving the death of an employee afflicted with heart disease, "which condition was aggravated and accelerated through and by the inhalation of noxious gases and smoke, commonly known as 'bas air' ". The board found that the preëxisting disease was 20 per cent. and the bad air 80 per cent. of the cause of death, and made an award proportionately. The action was based on Sec. 4880 of the Kentucky statutes, providing that "personal injury by accident . . . shall not include the results of a preëxisting disease but shall include injuries or death due to the inhalation in mines of noxious gases or smoke, commonly known as bad air", and on Sec. 2739-19, providing that "as working places advance, break-throughs for air shall be made 60 ft. apart". According to the evidence, Lucas and a companion were working at a place 100 ft. from a break-through or ventilation opening. In spite of considerable conflict in the expert medical testimony as to the cause of death, the court holds that there was ample evidence to sustain the board's conclusion and finding of fact.

Filing of Claim

Hudgins v. Nashville Bridge Co., Tennessee Supreme Court, decided February 12, 1938. The employee and plaintiff in this suit had an occupational disease, lead poisoning, alleged to be attributable to acts of negligence on the part of his employer. He instituted an action at law to recover damages, and the employer filed a plea that the Workmen's Compensation Act was a bar to such an action at law. Being somewhat in doubt as to the proper remedy, the employee within the statutory period of one year also instituted a proceeding under the Workmen's Compensation Act, with the intention that, if he should be mistaken in his remedy and unsuccessful in his common-law action, he might prosecute the compensation suit. The court rules that the institution of a suit for compensation does not operate as a waiver of the suit at law until it is prosecuted to final judgment. The statute as so interpreted would read: "A claim for compensation filed in a tribunal having jurisdiction to hear and determine it when prosecuted to final judgment shall be deemed a waiver of the right to proceed at law, and institution and prosecution to final judgment of an action at law shall be deemed a waiver of all claims to compensation hereunder". This construction, says the court, gives effect to what the court conceives to be the legislative intent, meets the justice of the case, protects the rights of an injured employee whose remedy may be doubtful, and works no hardship on the employer. In either case, where the employee recovers a judgment he can proceed no further in the other case.

Amendment to Complaint

Maty, Administratrix, v. Grasselli Chemical Co., U. S. Supreme Court, decided February 14, 1938. This is a reversal of an earlier decision of the U. S. Circuit Court of Appeals (89 Fed. [2d] 456), and the case is remanded to that court for further proceedings. The employee (plaintiff) alleged injuries while employed in the silicate department of defendant's chemical plant; later, and more than two years after the date of his injuries, he amended his complaint so as to include in the description of the place of employment where the injuries were sustained the phosphate department located in the same plant but in a different building 500 ft. away from the silicate department. The Circuit Court of Appeals held that the amendment to the complaint set out a new cause of action and was barred by the New Jersey statute of limitations. The Supreme Court holds that under the rule laid down by the New Jersey courts under the New Jersey statute, the amended complaint substantially alleged the same wrong as in the original complaint, relied upon the identical matter more fully and differently laid, and the essential elements of the action and the controversy remained the same between the parties after as before the amendment; that the New Jersey statute of limitations consequently did not bar the amended cause of action.



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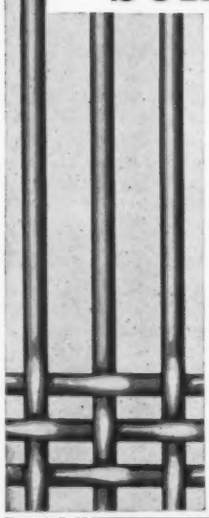

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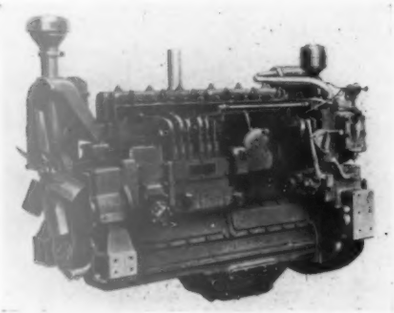
New Machinery and Supplies

● Industrial Engine

Adding to its line of industrial Diesel engines, the Caterpillar Tractor Co. has announced a new, 6-cyl., 66-hp. model to be known as the D4600. Exceptionally smooth running and unusually flexible, the model is well suited for use in shovels, draglines and hoists, or connected to a generator as an electric power producer.

The engine is of the four-stroke-cycle, valve in head, water cooled design, and features solid injection of the fuel into precombustion chambers. The fuel injection system is similar to that of all Caterpillar Diesels. Both the injection pumps and injection valves are set at the factory, and require no field adjustment.



New 66-hp. industrial Diesel engine.

The new engine will power ¾-cu. yd. shovels and drag-lines. As a source of electric current, it will be offered as a unit with a 35 kw. generator at 50 cycles at 1,500 r.p.m.; or as a 32½ kw. generator at 60 cycles at 1,200 r.p.m.

A 14-hp., 2-cyl. gasoline starting engine is mounted at the rear of the Diesel, directly over the flywheel housing, having a governed speed of 3,000 r.p.m. This engine cranks the Diesel through a pinion-and-clutch arrangement which automatically disengages when the larger engine fires. The starting engine offers a positive starting method under all climatic conditions. For indoor installations, where the atmospheric temperature is more or less constant, electrical starting is available.

● Concrete Unit

A new concrete-building unit, known as *Multi-Vent*, takes adavantage of the brick-type appearance and combines with that feature the economy of units of larger size.

The underlying principle, which was invented and perfected by J. J. Hine, an English architect, was to produce a unit which would be as easy to handle as the conventional brick, and at the same time have the economic advantages of the large building block.

Convention exhibit showing laid-up wall of the concrete units.

The unit is made in two sizes—4¼ by 8 by 12 in., and 2⅜ by 8 by 12 in. The unit has a center web, in addition to the outer webs, thus providing two vertical air spaces in the thickness of a standard 8-in. wall. Ends of the brick have alternating recesses and tenants, which facilitate laying the units as well as providing a weather strip effect in the vertical joint. In addition a series of special shapes has been developed so that all construction details can be met without cutting of the brick on the job. These special shapes include half-brick. The general appearance of walls of this unit, which has an exposed face of the standard brick size, is shown in the illustration, a booth at the recent Concrete Industrial Exposition held at Chicago.

While the unit has been made on various types of block-making equipment in England, arrangements have been made in the United States for its manufacture on equipment using the limited-amplitude vibration principle. The first installation has been made at the plant of Mahlstedt Materials, Inc., New Rochelle, N. Y., where the new unit is being produced for use in the Alden Estates project at Port Chester, N. Y. A study of the cost of construction with this unit indicates that it is considerably less than the cost of ordinary brick masonry walls, but slightly higher in price than exposed cinder-block structures. It is lower in cost than a concrete-masonry wall veneered with face brick of comparable appearance. F. H. Hedinger, 303 Lexington Ave., New York, N. Y., is the United States representative.

● Diesel Welder

A new Deisel engine, which differs radically from the popular conception of this type of power in that it compares favorably with gasoline engines in simplicity, weight and cost, as well as operating speed, has been adopted for driving arc-welding generators by the Lincoln Electric Co., Cleveland, in collaboration with Diesel-engine manufacturers.

The new Deisel-driven welder, shown in the accompanying illustration, is the result of extensive research and testing to develop a power plant of correct design and construction to meet requirements of welding service. Built to the specifications of Lincoln engineers, the Diesel engine has been operated in the field in severe service and has performed satisfactorily under all conditions.

This new Lincoln welder cuts fuel costs 33 to 86 per cent., depending upon the price of fuel oil used. For instance, at full load operation, it uses only 1.5 gal. of fuel oil per hour as compared to 2¾ gal. of gasoline

50 to 200% More Yardage!

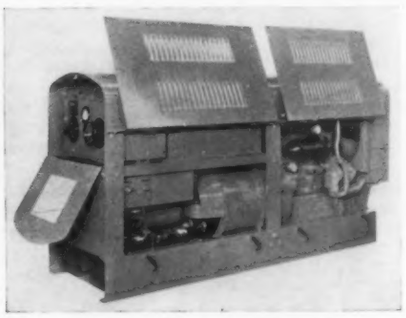
Yes Sir! On-the-job tests prove that Armco Dredge Pipe *outwears* ordinary pipe from 50 to 200 per cent. Tough, abrasion-resisting steel combined with the sturdy spiral welded construction also assures abundant strength and resistance to denting.

Diameters run from 6 to 36 inches; wall thicknesses as required. Any type of joint, including machine-contracted ends formed integral with the pipe. Lengths up to 60 feet for quick, easy handling. What quantities will you need for sand, gravel or water lines? The American Rolling Mill Co., Pipe Sales Div., 1231 Curtis St., Middletown, Ohio. Branch Offices in All Key Cities.

ARMCO

ARMCO DREDGE PIPE

Illustrated above is the new truck-mixer recently announced by Transit Mixers, Inc., New York, N. Y., which employs a centralized control from which the operator can control all the functions of the mixer and a new discharge door designed to speed up discharging and give improved control for partial discharge into small forms. Another new feature is an improved water-control device which may be manually set for introduction of any desired amount of water into the mixing drum and functions automatically thereafter. The water pump is capable of discharging as much as 75 g.p.m. into the drum.



Diesel-driven arc-welder.

per hour required for the conventional gasoline engine driven welder. In many cases, total savings including such items as transportation of fuel, loss, etc., are therefore, as high as 40c. per hour.

The arc-welding generator used on the new Diesel engine driven welding machine, is the 300-amp. Shield-Arc SAE unit equipped with dual-continuous control, a method of welding current control which provides the right size and type of arc for every application of electric welding.

The price of the new Diesel driven welder is said to compare favorably with that of gasoline-engine-driven arc-welding sets.

● Vibrating Screen

The latest mechanical improvements are incorporated in the improved Model C Leahy heavy-duty vibrating screen made by the Deister Concentrator Co., Fort Wayne, Ind.

A distinct feature of the new design is an electrically-welded structural steel bridge, integral with which is the outer encasement of the vibrator mechanism. This design is said to attain the advantages of an unbreakable bridge, plus double enclosure of the internal wearing parts of the vibrator to protect them from dust and abrasion, and positive translation of the characteristics of the patented Leahy vibration. Since the screen jacket is the only part of the equipment actually doing the sizing job, it is the only element vibrated in the Leahy—not the screen frame, supporting structure and building.

The screen consists of three essential elements: (1) the main screen frame, (2) the vibrator, and (3) the free-swinging screen jacket. Within the main frame the free-swinging screen jacket is tensioned. The vibrator imparts its characteristic and positive differential vibration to this jacket through a heavy connecting rod which at its lower end is attached to a rigid member extending transversly across the underside of the screen jacket.

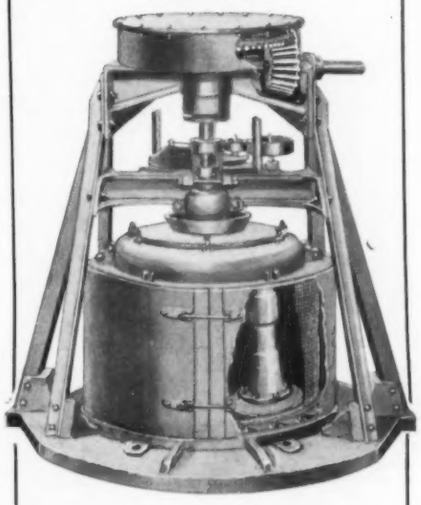
Improved model vibrating screen showing structural-steel bridge.

The all-welded-steel main frame is built of heavy structural channel and angle members for maximum strength and rigidity. This frame which remains stationary during operation of the screen, supports at its mid-section the bridge and vibrator assembly and mounts longitudinally within its enclosing members the screen jacket assembly.

Attention!

AGRICUTURAL LIMESTONE PRODUCERS

YOU WILL BE INTERESTED IN THIS NEW MILL WHICH PRODUCES A UNIFORM MATERIAL 100% THROUGH 20 MESH AT *A VERY LOW COST PER TON.*



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Complete Plants Designed and Equipped. Screens, Elevators, Conveyors, Quarry, Sand and Gravel Plant Equipment. Engineering Service.

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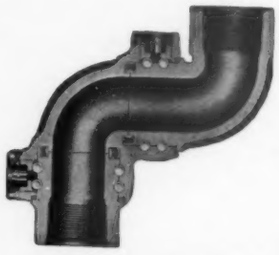
17 John Street New York, N. Y.

The slide rails for the screen jacket are assembled along the inner sides of the frame side channels, paralleling longitudinally the horizontal faces of these channels. On multiple surface screens a pair of slide rails is provided for each jacket.

Rubber side strips offer the final feature in the related parts of the frame and jacket. These strips, which for long life and effectiveness are of live rubber are fastened to the removable steel side boards and while assembled in the screen frame are in intimate resilient contact with the sides of the free-swinging screen jacket.

• Swing Joint

Chiksan Oil Tool Co., Ltd., Fullerton, Cal., has developed a ball bearing all-metal swing joint which is adaptable for all installations where movement is a factor. The patented construction of the joint sets it apart from other types of flexible connections. Double rows of hardened steel balls not only carry all radial loads, but also maintain a pre-regulated thrust load upon the packing element, keeping it always pressure-tight and leak-proof. The joint can not bind nor get out of adjustment. There is nothing to interfere with free and complete 360-deg. swiveling, and its sleek, stream-lined exterior has no projections to catch workmens' clothes. There are no packing glands to require constant tightening, and the joint is unaffected by heat, cold and a variety of corrosive fluids.



Ball-bearing swing joint.

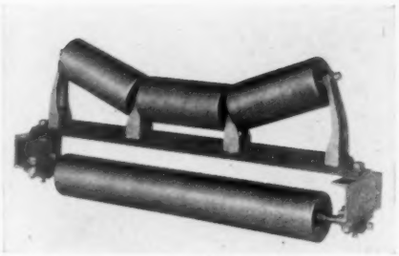
These joints are available in a wide variety of rotating actions, in steel, malleable iron, or aluminum. Sizes range from ¾ in. to 12 in. (and up to 18 in. on special order). They come in threaded, flanged or plain ends for connecting into all kinds of pipe, and are made for both high and low pressures.

The lightweight, simple design, high factor of safety and proven performance of Chiksan swing joints assure greater economy of operation for use on steam lines, water lines, portable coring units, water and fuel oil tanks (for protection against shifting ground), slurry tanks in cement plants and in machine and repair shops (lathes, drill presses, drill sharpeners, etc.).

• Conveyor Idler

A new inexpensive ball-bearing belt idler for carrying moderate loads of semi- and non-abrasive materials is announced by the Jeffrey Manufacturing Co., Columbus, O. This idler is of the conventional 3-pulley, 20-deg. troughing type, made for 14, 16, 18, 20, 24, 30, and 36-in. belts. Its ball bearings are of the commercial type, with a cork seal within a pressed-steel labyrinth dust cap.

Pulleys are of 4-in. diameter welded-steel pipe with formed steel gudgeons welded in the ends. These gudgeons are connected with-



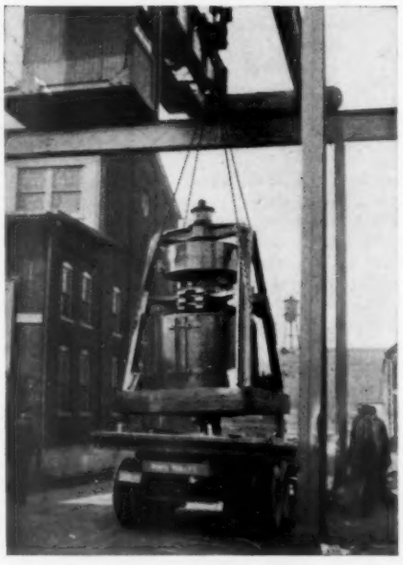
New conveyor idler.

in the pulley by steel tubing which prevents the loss of grease into the pulley proper. Shafts are ⅝-in. seamless tubing and are held by set screws within machine bored holes in the stands. As these shafts are hollow, the entire idler may be lubricated from either end through pressure fittings. Base angles are inverted to shed material.

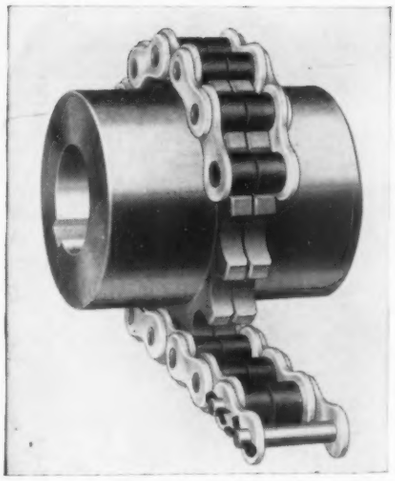
• Flexible Coupling

Announcement is made by the Link-Belt Co., of the development of a new flexible coupling, Type RCB, which embodies major improvements over the company's Type RC roller-chain coupling long furnished for connecting shafting in line.

The new coupling consists of two cut-tooth sprocket wheels (or coupling halves) which are connected by a piece of specially constructed single-width finished steel roller chain, using a recently-patented divided-roller feature which combines the advantage of double roller chain with the more rugged and simple construction of single-width chain. The divided roller provides independent roller action for each sprocket, and as the contact between roller and sprocket causes the roller to revolve on its bushing, any tendency to scuff the rollers and sprocket teeth is said to be



Giant Griffin mill being lowered to a truck for transportation from the factory of the Bradley Pulverizer Co., Allentown, Pa., to the Lehigh Portland Cement Co., Fogelsville, Pa., where it was installed, along with 10 others of the same type. Each of the eleven units weighed 26,000 lb. This was the first time the company has shipped these machines as complete units by motor-truck, according to S. R. Wolf of the Bradley concern.



The new flexible coupling showing divided-roller feature.

avoided. Longer coupling life, and extension of the range of efficient application, are claimed for the new coupling.

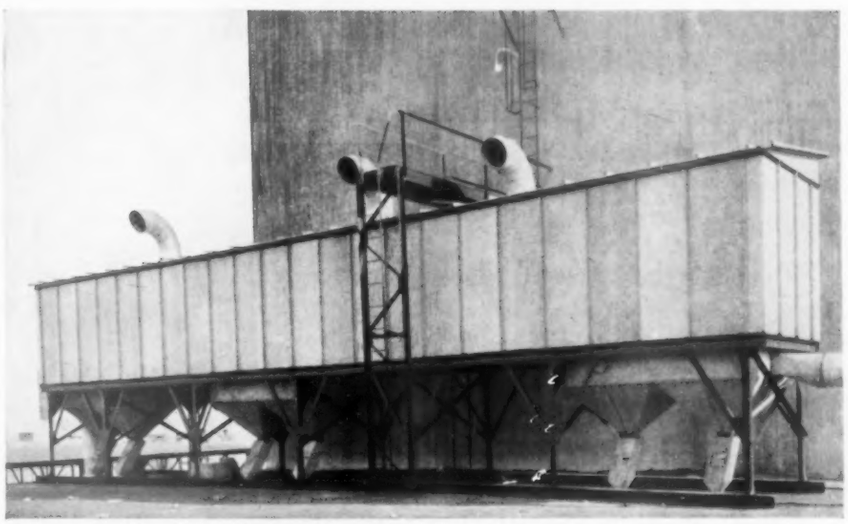
• Wrench Set

Armstrong Bros. Tool Co., Chicago, Ill., announce a new and interesting line of wrenches for hollow screws. Instead of wrenches formed from lengths of hexagonal-bar stock, the hollow-screw user can assemble a tool of size, shape and length needed from a set of interlocking drivers, handles, extensions and ratchets.

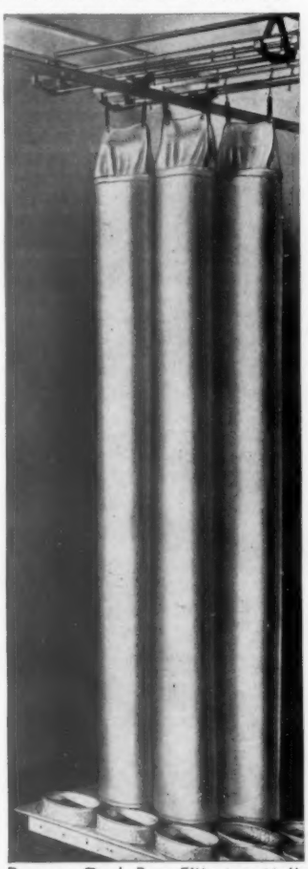
The Armstrong hollow screw wrench resembles in general a detachable head of a socket wrench, but in place of a socket to fit over a screw head, they have a protruding hexagonal driver that fits into the hollow screw. Ten sizes fit all hex nuts, hollow screws and cap screws from ¼ in. to 1 in. diameter. The wrenches, handles and extensions are made of chrome-vanadium tool steel. The reversible ratchets are drop forged with hardened steel gears, and it is claimed have an improved action. All wrenches and parts are chrome plated.

New low-priced automatic-priming pump, built of aluminum alloy and weighing only 52 lb., is being offered by the Jaeger Machine Co., Columbus, O. Its rated capacity of 5,200 gal. per hr. is said to be the largest ever developed by a pump of this light weight. The priming action, employing the Jaeger patented priming jet, insures fast self-priming at lifts up to 25 ft.

Take the "Dust" out of INDUSTRY



Parsons Oval Bag Dust Arrester at Medusa Portland Cement Co.



Parsons Oval Bag Filtering Units with patented overhead rockers and suspension springs.

PARSONS DUST CONTROL ENGINEERING

With every air-cleaning problem surrounded by totally different conditions, how important it is to have a dust collecting system properly engineered to your own plant. That is the Parsons method — which explains the sixteen years' success of Parsons installations for eliminating dust from screens, grinders, packers, kilns and other types of equipment.

Let Parsons study your requirements, and make recommendations for the most economical system of dust arresters or filtering units for your plant.

Parsons Simplified Dust Collecting Systems for Cement, Crushed Stone, Lime, Gypsum, Silica and Asphalt Plants.

Write for Bulletin DA-6

Dust Arresters and Complete Exhaust Systems

PARSONS

PARSONS ENGINEERING CORPORATION
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BUYERS' GUIDE

A Directory of Pit and Quarry Advertisers Indexed According to Product.

Although every effort is made to insure accuracy and completeness in these listings, the publisher cannot accept responsibility for errors or omissions. Any mistakes discovered will gladly be rectified

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*Warren Brothers Roads Co.

Agitators, Thickeners and Slurry Mixers
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*Manitowoc Engineering Works
*Smidth & Co., F. L.
*Traylor Engr. & Mfg. Co.

Air Compressors (Portable)
*Chicago Pneumatic Tool Co.

Air Compressors (Stationary)
*Chicago Pneumatic Tool Co.
Fuller Company

Air Conditioning
Jackson & Church Co.

Air Filters
*Blaw-Knox Co.
*Dracco Corporation
*Parsons Engineering Corp.
*Schneible Co., Claude B.
*Western Precipitation Co.

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*Gruendler Crusher & Pulverizer Co.
*Hardinge Co., Inc.
*Raymond Pulverizer Div. of Combustion Engr. Co., Inc.
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Stulz-Sickles Co.

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*Link Belt Co.
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*Fuller Company
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*Merrick Scale Mfg. Co.

Backfillers
*Bucyrus-Erie Co.
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Balls (Grinding)
*Hardinge Co., Inc.
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*Manitowoc Engineering Works

Bearings (Anti-Friction)
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*Link-Belt Co.
Robins Conveying Belt Co.
*Sprout, Waldron & Co.
Timken Roller Bearing Co.

Bearings (Roller)
Timken Roller Bearing Co.

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Flexible Steel Lacing Co.

Belt Lacings
Armstrong-Bray & Co.
Flexible Steel Lacing Co.

Belting
*Cincinnati Rubber Mfg. Co.
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*Haiss Mfg. Co., Geo.
*Link-Belt Co.
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*Sprout, Waldron & Co.
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Goodyear Tire & Rubber Co.

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United States Rubber Co.

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*Fuller Company.
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*Robins Conveying Belt Co.
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Blasting Supplies
*Ensign-Bickford Co.

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Multiplex Concrete Machinery Co.

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Dunn Mfg. Co., W. E.
Multiplex Concrete Machinery Co.
R & L Concrete Machinery Co.

Blocks (Pillow)
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American Manganese Steel Co.
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Bodies (Motor Truck, Concrete Mixing)
*Blaw-Knox Co.
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Boots (Rubber)
Goodyear Tire & Rubber Co.
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Borings, Core
Hoffman Bros. Drilling Co.
Pennsylvania Drilling Co.

Brick Machines (Concrete)
Dunn Mfg. Co., W. E.
R & L Concrete Machinery Co.

Brick Manufacturing Equipment
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Jackson & Church Co.

Bronze Work (Ornamental)
National Wire Cloth Co.
*Tyler Co., W. S.

Bucket Elevators (See Conveyors and Elevators)

Buckets (Clamshell, Orange-Peel, Etc.)
*Blaw-Knox Co.
*Haiss Mfg. Co., Geo.
*Link-Belt Co.
Owen Bucket Co.

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*Jaeger Machine Co.

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Buckets (Elevator and Conveyor)
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*Hendrick Mfg. Co.
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McLanahan and Stone Corp.
*Robins Conveying Belt Co.
Smith Engr. Works
*Sprout, Waldron & Co.

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*Koehring Co.

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*Sprout, Waldron & Co.

Bushings
Maddox Foundry & Machine Works

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*Calcium Chloride Association

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Car Dumpers
*Link-Belt Co.

Car Pullers
Jackson & Church Co.
*Link-Belt Co.
Maddox Foundry & Machine Works

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*Link-Belt Co.
*Robins Conveying Belt Co.
Smith Engr. Works
*Sprout, Waldron & Co.

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Car Wheels — (See Wheels — Car)

Cars (Block, Concrete)
Multiplex Concrete Machinery Co.

Cars (Quarry and Gravel Pit)
Maddox Foundry & Machine Works

Castings
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*Eagle Iron Works
*Hardinge Co., Inc.
Hetherington & Berner, Inc.
Holmes & Bros., Inc., Robt.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
Maddox Foundry & Machine Works
McLanahan and Stone Corp.
*Robins Conveying Belt Co.
*Sprout, Waldron & Co.

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*Jaeger Machine Co.
*Sprout, Waldron & Co.

Chain (Dredge and Shovel)
Manganese Steel Forge Co.

Chain Drives
*Jeffrey Mfg. Co.
*Link-Belt Co.

Chain (Elevating and Conveying)
American Manganese Steel Co.
*Haiss Mfg. Co., Geo.
*Link-Belt Co.
Manganese Steel Forge Co.
*Sprout, Waldron & Co.

Chutes and Chute Liners
American Manganese Steel Co.
Goodyear Tire & Rubber Co.
*Haiss Mfg. Co., Geo.
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Classifiers
Bradley Pulverizer Co.
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Clutches
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Coal-Pulverizing Equipment
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*Chicago Pneumatic Tool Co.

Concrete Mixers
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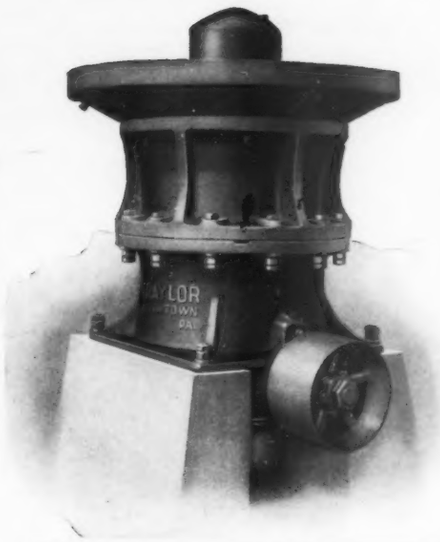
Conveyors and Elevators
Allen-Sherman-Hoff Co.

* See also information in the 1938 Pit and Quarry HANDBOOK.



Our new Type H Blake Jaw Crusher is another winner — send for Bulletin 105 and learn about it!

big output at the lowest cost-per-ton you ever knew— that's the

TRAYLOR
TY REDUCTION CRUSHER

There's much more to say about it—such as entire reliability; the practically fool-proof construction; the extremely simple, yet scientific design—but the story can't be told here. It takes a whole book—our Bulletin 3012—to tell it all, a book you should get without delay. If you'd prefer to have our man around to "talk it over"—THAT would suit us best of all. Why not write us, now?

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Export Department—104 Pearl St., New York City. Foreign Sales Agencies: London, Lima, Sao Paulo, Rio de Janeiro, Buenos Aires, Santiago, Valparaiso, Antofagasta, Iquique, Oruro
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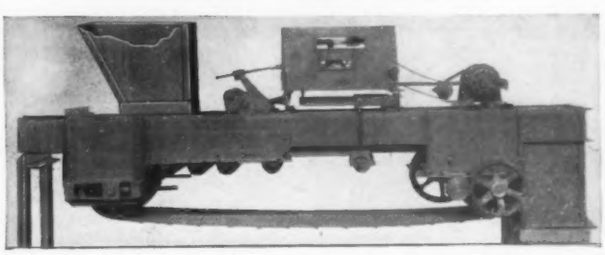
Weigh your Bulk Materials *"on the move"*

Successful operators insist upon the

WEIGHTOMETER and FEEDOWEIGHT

Some have more than 20 installations

THE MERRICK FEED-O-WEIGHT



This MERRICK automatically feeds material by weight. It weighs, totals and registers the material fed. May be applied to existing belt feeders.

The FEED-O-WEIGHT is equipped with a power operated feed and control gate, allowing the beam of the scale to always freely assume its true position of equilibrium—a unique feature of FEED-O-WEIGHT and essential to accurate operation.

Use FEED-O-WEIGHT for proportioning Raw Mix—Limestone & Shale—Clinker & Gypsum.

INSTALLATION OF MERRICK WEIGHTOMETER

MERRICK installations all over the WORLD give accurate production figures at minimum expense. You too can depend on a MERRICK and make substantial savings by a constant check-up on tonnage produced and shipped.

MERRICK SCALE MFG. COMPANY
PASSAIC NEW JERSEY

MERRICK CONVEYOR WEIGHTOMETER

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*Robins Conveying Belt Co.
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*Sauerman Bros., Inc.

Dragline Excavators
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*Allis-Chalmers Mfg. Co.
*Blaw-Knox Co.
*Dracco Corporation
*Parsons Engineering Corp.
*Raymond Pulverizer Div. of Combustion Engr. Co., Inc.
*Schneible Co., Claude B.
*Western Precipitation Corp.

Dust Conveying Systems
Allen-Sherman-Hoff Co.
*Blaw-Knox Co.
*Dracco Corporation
*Fuller Company
*Parsons Engineering Corp.
*Schneible Co., Claude B.
*Western Precipitation Corp

Dust Filters
*Parsons Engineering Corp.
*Schneible Co., Claude B.
*Western Precipitation Corp

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*Allis-Chalmers Mfg. Co.

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*Allis-Chalmers Mfg. Co.
Bacon, Inc., Earle C.
Bradley Pulverizer Co.
*Fuller Company
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*Kennedy-Van Saun Mfg. and Eng. Corp.
McLanahan and Stone Corp.
*Robins Conveying Belt Co.
*Smidth & Co., F. L.
*Sprout, Waldron & Co.
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*Chicago Pneumatic Tool Co.
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*Nordberg Mfg. Co.

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Caterpillar Tractor Co.
*Chicago Pneumatic Tool Co.
Murphy Diesel Co., Ltd.
*Nordberg Mfg. Co.

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Maddox Foundry & Machine Works
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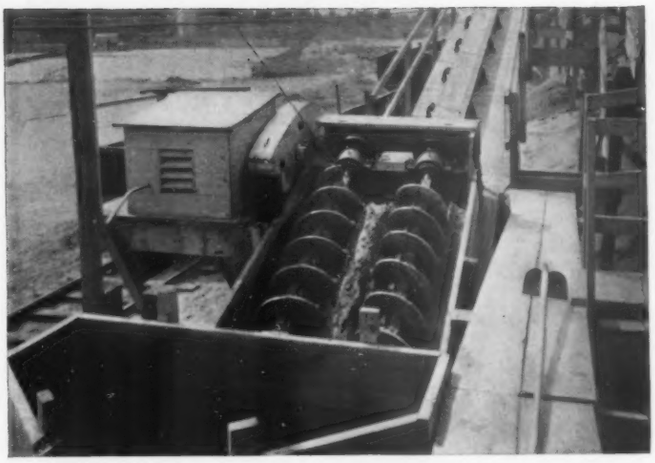
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.

* See also information in the 1938 Pit and Quarry HANDBOOK.



EAGLE SCREW WASHER

Daily recovers over six cars of sand formerly wasted

Eagle Screw Washer Daily Recovers Over Six Cars of Sand Formerly Wasted.

The Concrete Materials Corporation of Waterloo, Iowa, installed this 18 inch twin screw washer which recovers commercial sand able to qualify for the Illinois State Specifications. Before this installation only gravel was produced and the sand pumped back into the lake, a total loss.

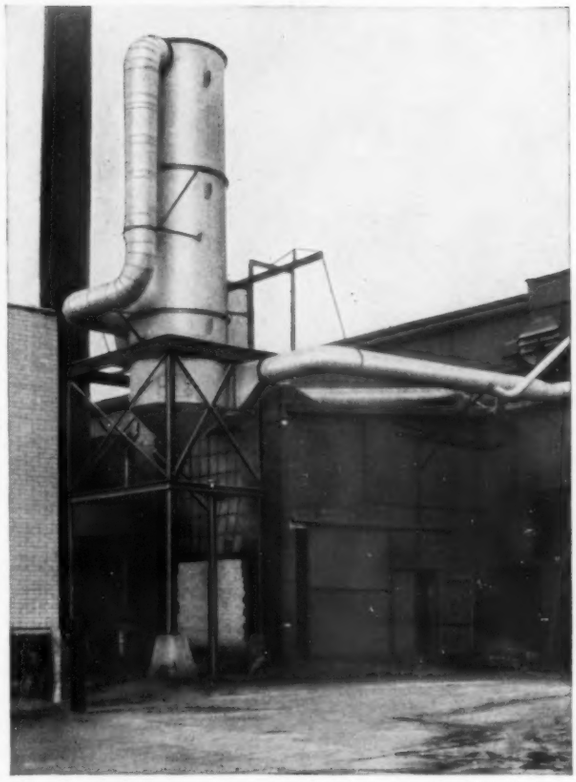
Two other pieces of EAGLE equipment play a very important part in the remarkable production record of the plant. A 40 foot "Swintek" ladder mounted on a barge is used for excavating, and a 20-inch twin screw EAGLE WASHER effectively washes and dewaters about 80 tons of sand per hour for mixing with gravel to meet the specifications for ballast.

This is only one of countless ways EAGLE WASHERS are building big profits for producers everywhere.

Our engineers are specialists in all aggregate washing problems. Let us help you solve yours. Write today for details.

EAGLE IRON WORKS
DES MOINES, IOWA

End Dustruction
IN YOUR PLANT
with the
SCHNEIBLE MULTI-WASH DUST COLLECTOR...



Dust is destructive! It destroys machinery through abrasion and may impair the health of workers. The Schneible Multi-Wash Dust Collector positively and efficiently collects dust without damage to itself because it employs no bags, screens or filters to clog, or moving parts to wear from dust abrasion. It uses only clear water under normal pressure to wash the air. All parts are copper bearing alloy steel, and they are protected against abrasion by the water used in the washing process.

No other system of dust control offers the high efficiency, the low operating cost, and the low maintenance cost provided by Schneible Multi-Wash Dust Collectors.

End *dustruction* permanently in your plant as many others have done. Write for Bulletin 110 which gives complete operating data and lists over sixty representative users who employ hundreds of installations.

CLAUDE B. SCHNEIBLE CO.
DUST SUPPRESSION ENGINEERS
3951 LAWRENCE AVENUE, CHICAGO — OFFICES IN PRINCIPAL CITIES

FROM

Gumbo to Gold WHITCOMB HAULAGE WINS

● The first mine locomotive was built by Whitcomb in 1906, and a few years later, Whitcomb adapted the gasoline motor to other types of industrial locomotives. You find them in far corners of the globe, hauling material of every description with economy and dispatch — moving everything from mountains to merchandise.

It's always "smooth going" for a Whitcomb Locomotive. A roadway of steel rails permits one man to haul many loads at one time, with less fuel cost. An equally important factor in their economy is long life and low upkeep. Put your haulage on rails, and investigate the advantages of equipment backed by the combined resources, experience and facilities of Whitcomb and Baldwin.

Our engineers will gladly make a survey of your needs and make impartial recommendations.

A size and type to suit your needs

Gasoline or Diesel Mechanical Drive
Gasoline or Diesel Electric Drive
Electric Storage Battery
Electric Trolley

THE WHITCOMB LOCOMOTIVE COMPANY

Plant at Rochelle, Illinois

Subsidiary of The Baldwin Locomotive Works, Paschall Station Post Office, Philadelphia, Pennsylvania.

WHITCOMB LOCOMOTIVES

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* See also information in the 1938 Pit and Quarry HANDBOOK.

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*Sprout, Waldron & Co.

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Hetherington & Berner, Inc.

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Hetherington & Berner, Inc.
Naylor Pipe Co.
Taylor Forge & Pipe Works

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R & L Concrete Machinery Co.

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R & L Concrete Machinery Co.

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Maddox Foundry & Machine Works
*Williams Patent Crusher & Pulverizer Co.

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*Sprout, Waldron & Co.

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*Raymond Pulverizer Div. of Combustion Engr. Co., Inc.

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Brooks Equipment & Mfg. Co.
*Gruendler Crusher & Pulverizer Co.
*Hardinge Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machine Co.
New Holland Machine Co.
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*Williams Patent Crusher & Pulverizer Co.

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*Smidth & Co., F. L.

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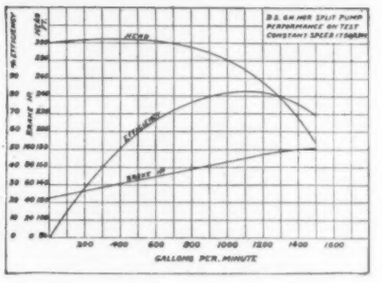
American Manganese Steel Co.
Erie Pump & Engine Works
Hetherington & Berner, Inc.
*Jaeger Machine Co.
Kansas City Hay Press Co.
Maddox Foundry & Machine Works
*Morris Machine Works

Pumps (Dewatering)
*Allis-Chalmers Mfg. Co.

* See also information in the 1938 Pit and Quarry HANDBOOK.

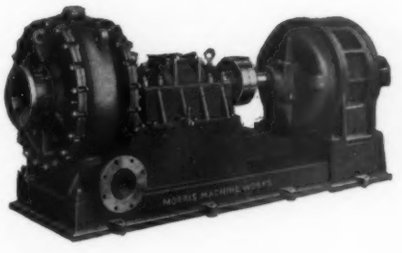
The MORRIS HYDRAULIC COLUMN

News of interest to Centrifugal Pump Users



High, wide, and handsome...

This eulogistic group of adjectives particularly well characterizes the efficiencies of Morris Centrifugal Pumps. Morris efficiencies are uniformly ***high.*** Equally important, Morris efficiency curves are ***wide***—that is, Morris Pumps operate over a wide range of capacities at high efficiencies. And finally, if "handsome is as handsome does", Morris Pumps certainly do handsomely by their owners, for Morris Pumps ***continue*** to operate at high efficiency for long periods. Would you like to know more about pumps with these desirable characteristics? A post card will bring complete information.



+ & X . . . .

The mathematics of Morris installations usually involves addition and frequently multiplication. Which, speaking more plainly, simply means that after trying one Morris Centrifugal Pump, plant engineers come back to Morris when they need more. The reasons? You will find them in Morris bulletins which are awaiting your request.

For authoritative recommendations on any pumping or dredging problem, write to Morris Machine Works, Baldwinsville, N. Y. Representatives in Principal Cities.

BUYERS' GUIDE

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Erie Pump & Engine Works
*Morris Machine Works

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Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
*Bucyrus-Erie Co.
Erie Pump & Engine Works
Hetherington & Berner, Inc.
Kansas City Hay Press Co.
Maddox Foundry & Machine Works
*Morris Machine Works

Pumps (Sand and Gravel)
Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
Erie Pump & Engine Works
Hetherington & Berner, Inc.
Kansas City Hay Press Co.
Maddox Foundry & Machine Works
*Morris Machine Works

Pumps (Sump)
*Chicago Pneumatic Tool Co.

Pumps (Turbine)
*Allis-Chalmers Mfg. Co.
Erie Pump & Engine Works
*Morris Machine Works

Pumps (Vacuum)
*Chicago Pneumatic Tool Co.
*Fuller Company

Pumps (Vertical)
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Erie Pump & Engine Works
*Morris Machine Works

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Erie Pump & Engine Works
*Morris Machine Works

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Ready-Mixed Concrete Plants
Bartlett & Snow Co., C. O.
*Jaeger Machine Co.

Recuperators
*Manitowoc Engineering Works

Rock Drills (See Drills—Rock)

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*Hardinge Co., Inc.
Jackson & Church Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Traylor Engr. & Mfg. Co.

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Stulz-Sickles Co.

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*Link-Belt Co.

Sand Separators
*Link-Belt Co.
McLanahan and Stone Corp.
Smith Engr. Works

Sand—Lime—Brick Machinery
*Hardinge Co.
Jackson & Church Co.

Sand-Settling Tanks
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*Nordberg Mfg. Co.
Smith Engr. Works

Scales
*Merrick Scale Mfg. Co.

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*Merrick Scale Mfg. Co.

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Continental Roll & Steel Fdry. Co.
*Link-Belt Co.
*Sauerman Bros., Inc.

Scrapers (Wagon)
*Bucyrus-Erie Co.
Continental Roll & Steel Fdry. Co.

Screens
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
Bacon, Inc., Earle C.
Chicago Perforating Co.
Cleveland Wire Cloth & Mfg. Co.
*Deister Concentrator Co.
*Deister Machine Co.
*Eagle Iron Works
*Gruendler Crusher & Pulverizer Co.
*Haiss Mfg. Co., Geo.
*Hardinge Co., Inc.
*Hendrick Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
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*Robins Conveying Belt Co.
*Roebling's Sons Co., John A.
Simplicity Engr. Co.
Smith Engr. Works
*Sprout, Waldron & Co.
Sturtevant Mill Co.
*Traylor Engr. & Mfg. Co.
*Tyler Co., W. S.

Screens (Vibrating or Shaking)
*Allis-Chalmers Mfg. Co.
*Deister Concentrator Co.
*Deister Machine Co.
*Gruendler Crusher & Pulverizer Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machine Co.
*Link-Belt Co.
Maddox Foundry & Machine Works
McLanahan and Stone Corp.
New Holland Machine Co.
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Screen Equipment Co.
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American Rolling Mill Co.

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*Bay City Shovels, Inc.
*Bucyrus-Erie Co.
*Koehring Co.
*Link-Belt Co.
*Manitowoc Engineering Works
Northwest Engr. Co.
Thew Shovel Co.

Silos
*Smidth & Co., F. L.

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*Allis-Chalmers Mfg. Co.
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Holmes & Bros., Inc., Robt.

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*Deister Concentrator Co.

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*Link-Belt Co.
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*Calcium Chloride Association

Stacks (Smoke)
Maddox Foundry & Machine Works

Steel (Alloy)
(See Alloys—Steel)

Steel (High Tensile)
American Manganese Steel Co.
American Rolling Mill Co.
Manganese Steel Forge Co.

Steel (Open Hearth)
American Manganese Steel Co.
American Rolling Mill Co.
Manganese Steel Forge Co.

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Hetherington & Berner, Inc.
Holmes & Bros., Inc., Robt.
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*Sprout, Waldron & Co.

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Owen Bucket Co.

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*Haiss Mfg. Co., Geo.
*Link-Belt Co.
*Sauerman Bros., Inc.

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Tamp Machines (Hand, Concrete)
Multiplex Concrete Machinery Co.

Tanks
Bartlett & Snow Co., C. O.
*Hendrick Mfg. Co.
Jackson & Church Co.
*Link-Belt Co.
Maddox Foundry & Machine Works
*Schneible Co., Claude B.
*Traylor Engr. & Mfg. Co.

Tanks (Dewatering)
*Schneible Co., Claude B.

Tanks (Sand-Settling)
*Link-Belt Co.
Smith Engr. Works

Testing Sieves and Shakers
*Hendrick Mfg. Co.
*Tyler Co., W. S.

Tire Repair Materials
Goodyear Tire & Rubber Co.
United States Rubber Co.

Tires (Truck, Passenger Car, Tractor)
Goodyear Tire & Rubber Co.
United States Rubber Co.

Tools (Drill) (See Drilling Accessories)

Track Shifters
*Nordberg Mfg. Co.

Tractors
*Allis-Chalmers Mfg. Co.
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Tramways (Aerial)
*Roebling's Sons Co., John A.

Transformers
*Allis-Chalmers Mfg. Co.

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Transmission Machinery
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
*Gruendler Crusher & Pulverizer Co.
*Link-Belt Co.

Trippers
*Link-Belt Co.
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*Blaw-Knox Co.
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*Allis-Chalmers Mfg. Co.

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*Fuller Co.
*Link-Belt Co.

Valves (Pump)
*Cincinnati Rubber Mfg. Co.
Taylor Forge & Pipe Works

Variable Speed Reducers or Transmissions
*Link-Belt Co.

Vibrating Screen Plate
Chicago Perforating Co.
*Hendrick Mfg. Co.
*Link-Belt Co.
Manganese Steel Forge Co.

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*Tyler Co., W. S.

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*Eagle Iron Works
*Haiss Mfg. Co., Geo.
*Hardinge Co., Inc.
*Kennedy-Van Saun Mfg. and Eng. Corp.
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*Link-Belt Co.
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*Smidth & Co., F. L.
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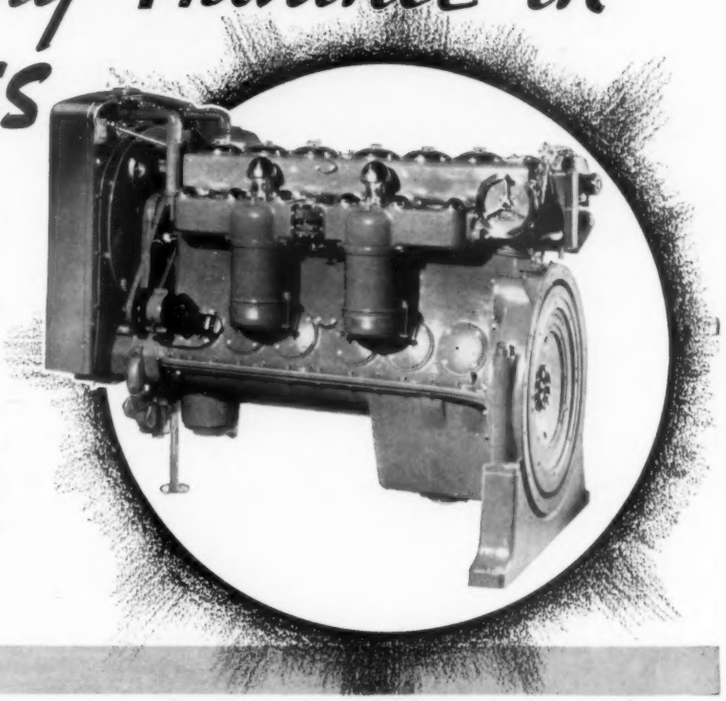
*Traylor Engr. & Mfg. Co.
*Tyler Co., W. S.

Weighing Equipment (Automatic)
*Blaw-Knox Co.
*Fuller Co.
*Jaeger Machine Co.
*Merrick Scale Mfg. Co.

Welding Bars, Wedge and Applicator (Nickel - Manganese Steel)
Stulz-Sickles Co.

* See also information in the 1938 Pit and Quarry HANDBOOK.

The outstanding Advance in DIESEL ENGINES



IT is simple . . . No separate starting engine . . . . Fuel injector and pump are combined in one unit—interchangeable—replaceable in a minute's time—eliminating at once many present Diesel difficulties.

Don't buy a Diesel Engine without getting all the facts on this outstanding power plant. Let us send you the whole story.

MURPHY DIESEL

MURPHY DIESEL COMPANY LTD.
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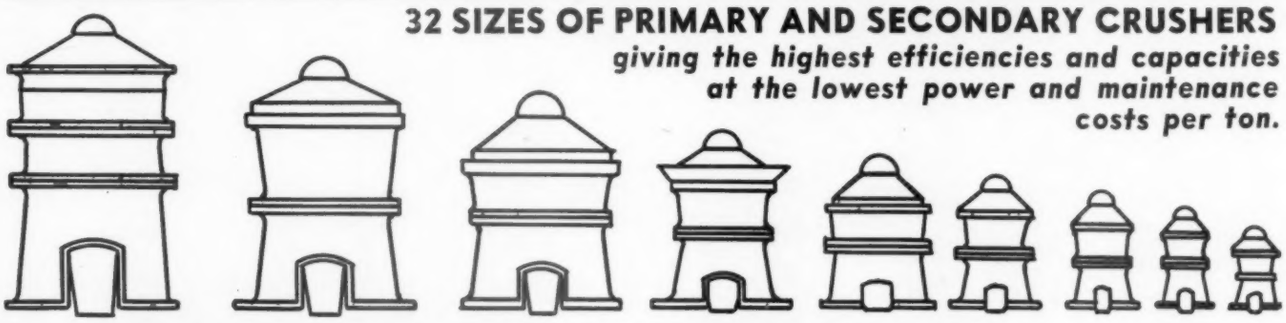
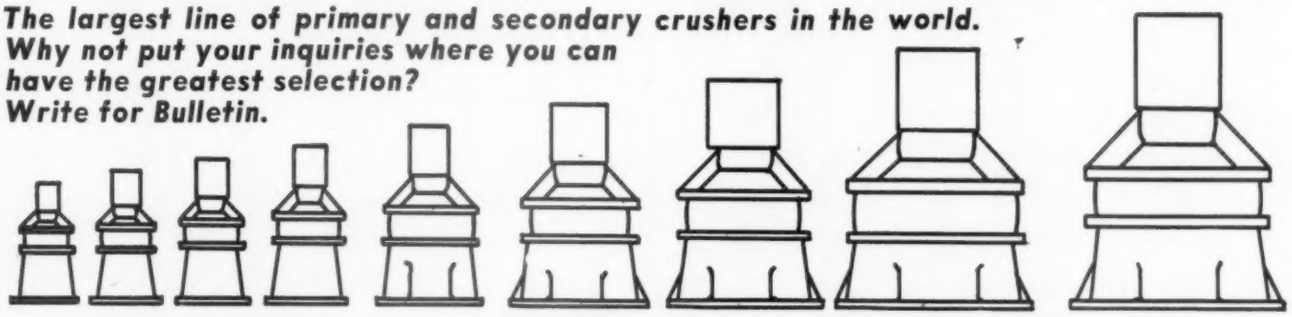
32 SIZES OF PRIMARY AND SECONDARY CRUSHERS
giving the highest efficiencies and capacities at the lowest power and maintenance costs per ton.



The largest line of primary and secondary crushers in the world.
Why not put your inquiries where you can have the greatest selection?
Write for Bulletin.



Also a complete line of Jaw, Roll Hammer, and Slugger Roll Crushers.
Have one of our engineers call without obligation on your part.

KENNEDY - VAN SAUN MFG. & ENG. CORP.
2 Park Avenue New York, N. Y.

Sales Agents in all Principal Cities of the United States.

BUYERS' GUIDE

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Union Wire Rope Co.

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*Roebling's Sons Co., John A.
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Manganese Steel Forge Co.
*Roebling's Sons Co., John A.

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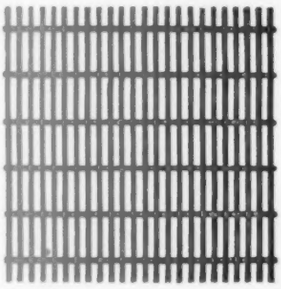
* See also information in the 1938 Pit and Quarry HANDBOOK.



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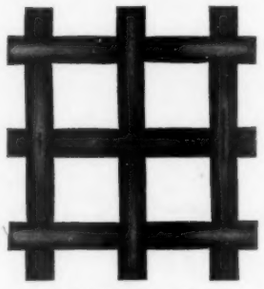
ALLOY No. 2

A super wearing Steel developed to resist the abrasion and vibration of modern screening demands.

"CLEVELAND" SCREENS

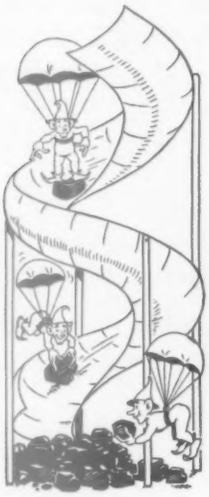
A wire cloth of guaranteed accuracy backed by fine workmanship and an effort to satisfy.

Available in Square Mesh and Rolled Slot. A trial will convince you of the superiority.



2 Mesh .162 Ga.

THE CLEVELAND WIRE CLOTH & MFG. COMPANY
574 E. 78th St. CLEVELAND, OHIO



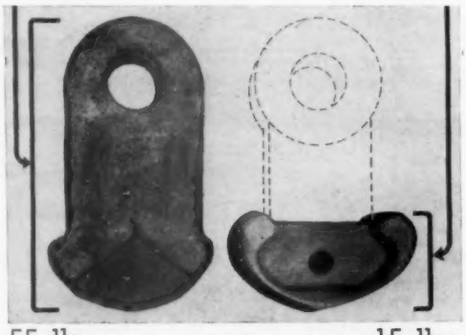
ROUND AND ROUND IT GOES
NO DEGRADATION
NO BREAKAGE

Handle your sized material with Holmes Lowering Spirals. The gentle sliding descent of materials prevents breakage or degradation—saves you money and eliminates wastage. Operated by gravity these lowering spirals have no power cost.

Tailored to your particular requirements, Holmes Lowering Spirals will give the utmost in efficiency and economy. Let our engineers consult with you.

ROBERT HOLMES & BROS.
INCORPORATED
DANVILLE ILLINOIS

DO YOU THROW AWAY
THIS - - - or - - - THIS



55 lbs. - - - or - - - 15 lbs.
when you replace your hammers
Let us tell you the savings effected by using

ESCO RENEWABLE HEAD HAMMERS

These hammers have been used by several leading cement mills on the Pacific Coast for several years with complete success. Write today.

Patented

ELECTRIC STEEL FOUNDRY CO.
Portland, Oregon
Seattle, San Francisco, Los Angeles
Denver

The VANDERWERP RECUPERATOR for Rotary Kilns

The Recuperator is now accepted as the one and only air-quenching type of cooler offering adequate protection against excessive expansion in high-magnesia cements. It insures:

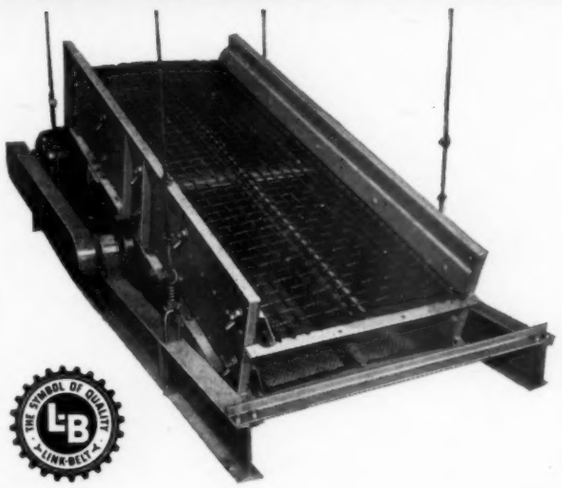
- *Improved Quality of Cement*
- *Better Grindability of Clinker*
- *Maximum Fuel Economy*
- *Highest Efficiency of Heat Recovery*
- *Low Maintenance Cost*

Kiln operators interested in obtaining the maximum benefits from air quenching and heat recovery — with proven equipment — are requested to write, without obligation, for full particulars.

Manitowoc Engineering Works

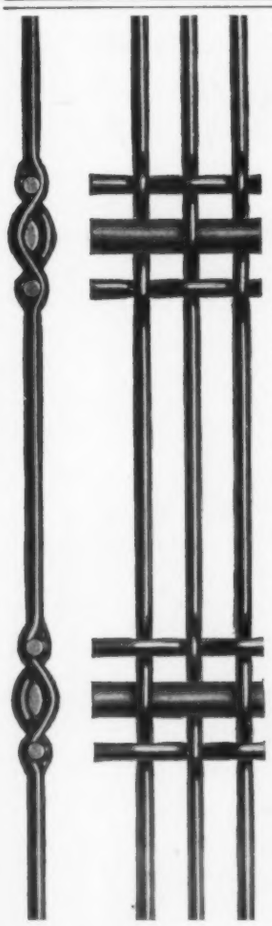
Division of
Manitowoc Ship Building Company
GENERAL OFFICES AND PLANT — Manitowoc, Wisconsin
CHICAGO OFFICE — 131 E. River St.

LINK-BELT *Vibrating* SCREENS



● Made in two distinct types, for handling sand, gravel, crushed stone, coal, coke, clay, lime, fertilizer, ores, grain, sugar, chemicals, pulpwood chips, etc. Send for Catalog No. 1562. Address Link-Belt Company, Philadelphia, Chicago, Indianapolis, Atlanta, San Francisco, or any of our offices, located in principal cities.

72828



STA-TRU
Long-Mesh Woven Wire Screens

made to work under tension and vibration.

The straight stay - bars carry ALL the tension. The crimps in the round wires can not be stretched or broken. The screen can not be caused to sag or split by the pull of the tensioning device.

LUDLOW-SAYLOR
WIRE CO. — ST. LOUIS

Control DUST FOG FUME MIST

Western Precipitation Corporation engineers design dust control systems according to their studies of specific problems, and make installations of Cottrell Precipitators, Multiclones, Polyclones, Impax Separators or other equipment of the correct type and size to handle a given gas volume at a guaranteed efficiency.

Send for Free Bulletin.

WESTERN PRECIPITATION CORPORATION
1016 West 9th St., Los Angeles, California ● New York, N. Y.
COTTRELL PRECIPITATORS . . . MULTICLONES . . . SPRAY DRYERS
PIONEER IN DUST AND FUME CONTROL

HYDROSEAL

MAXIMIX RUBBER PROTECTION

DREDGE PUMPS

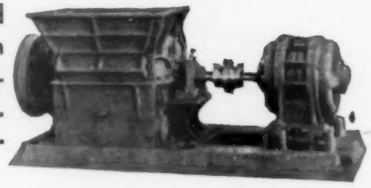
See our advertisement on Inside Front Cover of Last Month's Issue

The ALLEN-SHERMAN-HOFF CO.
223 S. 15th Street Philadelphia

AMERICAN CRUSHERS

for Greater Tonnage at Lower Cost

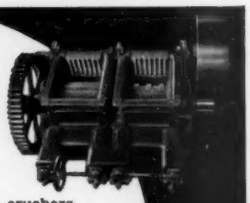
Hammermill and Ring Mills built in many sizes for numerous requirements. Tell us your reduction problems.



AMERICAN PULVERIZER COMPANY
1289 MACKLIND AVE. ST. LOUIS, MO.

McLANAHAN EQUIPMENT

for ROCK—SAND—GRAVEL

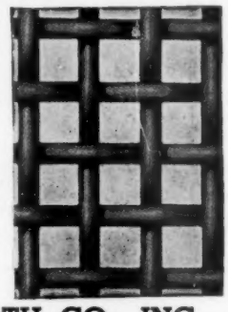


Single and double roll and jaw crushers, hammer mills, super dry pans, steel log washers and scrubbers, sand drags, revolving and vibrating screens, elevators, conveyors, dryers, jigs, hoists. Complete portable, semi-portable and stationary crushing, screening and washing plants for different capacities of any materials.

McLanahan & Stone Corporation
Established 1835
Hollidaysburg, Pennsylvania

FIVE STAR FEATURES

of Nat-aloy Wire Cloth



- ★ Wears five to ten times as long as cloth made of ordinary steel
- ★ Withstands vibration without crystallization
- ★ Super-tough to resist abrasion
- ★ Maintains accuracy throughout life of screen
- ★ Economical in price and serviceability

Attractive Prices
Immediate Shipments from Stock

NATIONAL WIRE CLOTH CO., INC.
St. Paul, Minn. Write for new catalog No. 36.

PIT AND QUARRY

Research Department

538 South Clark St., Chicago, Ill.

Please send me catalogs and prices concerning the following items checked below:

- ☐ Agitators, sand and Gravel
- ☐ Agitators, Slurry
- ☐ Aggregate — Bituminizing Plants
- ☐ Air cleaners
- ☐ Air compressors
- ☐ Asphalt Mixing Plants
- ☐ Asphalt Mixers
- ☐ Bag fillings nd weighing machinery
- ☐ Bags, cloth
- ☐ Bags, paper
- ☐ Balls, steel
- ☐ Barges, steel
- ☐ Belt Dressing
- ☐ Belt fasteners
- ☐ Belting, conveyor and elevator
- ☐ Belting, transmission
- ☐ Belt lacing
- ☐ Belt plates
- ☐ Belt rivets
- ☐ Belt tighteners
- ☐ Bin gates
- ☐ Bins, concrete
- ☐ Bins, steel
- ☐ Blasting supplies
- ☐ Blasting powder
- ☐ Blocks, friction
- ☐ Boats, self-unloading
- ☐ Bodies, Motor Trucks
- ☐ Brake Linings
- ☐ Buckets, Clamshell
- ☐ Buckets, Conveyor and Elevator
- ☐ Buckets, Dragline
- ☐ Buckets, Orange Peel
- ☐ Cableways, Slackline
- ☐ Calcining Machinery
- ☐ Car Dumpers
- ☐ Car Pullers and Movers
- ☐ Carriers, Belt
- ☐ Cars, Dump
- ☐ Cars, Kiln
- ☐ Castings, Manganese Steel
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- ☐ Chains, Conveyor and Elevator
- ☐ Chains, Power Shovel, Crane and Dredge
- ☐ Chains, Transmission
- ☐ Chutes
- ☐ Classifiers
- ☐ Clips, Wire Rope
- ☐ Clutches
- ☐ Clutches, Magnetic
- ☐ Concrete Plants, Ready Mixed
- ☐ Cones, Washing
- ☐ Conveyors, Apron
- ☐ Conveyors, Belt
- ☐ Conveyors, Pneumatic
- ☐ Conveyors, Screw
- ☐ Conveyors, Skip
- ☐ Coolers
- ☐ Couplings, Flexible
- ☐ Couplings, Hose
- ☐ Cranes, Locomotive
- ☐ Cranes, Overhead Traveling
- ☐ Cranes, Truck
- ☐ Crushers, Cone
- ☐ Crushers, Disc
- ☐ Crushers, Gyratory
- ☐ Crushers, Hammer
- ☐ Crushers, Jaw
- ☐ Crushers, Ring
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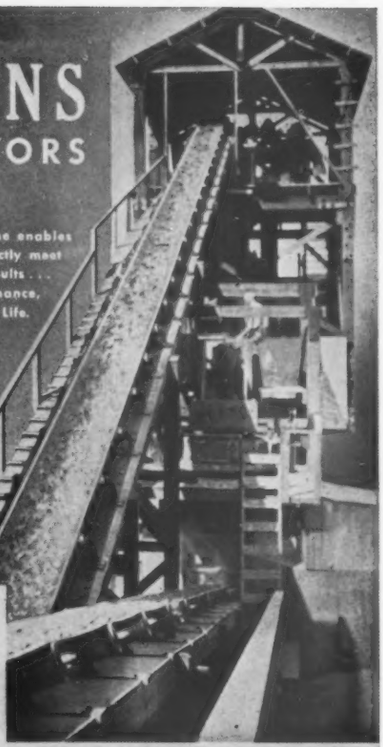

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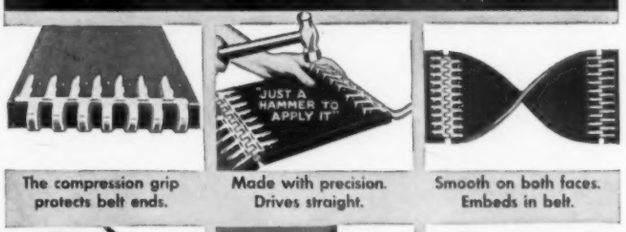

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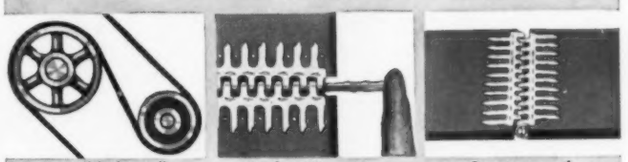

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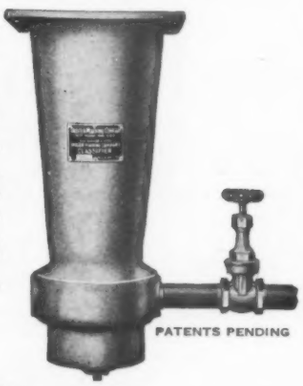

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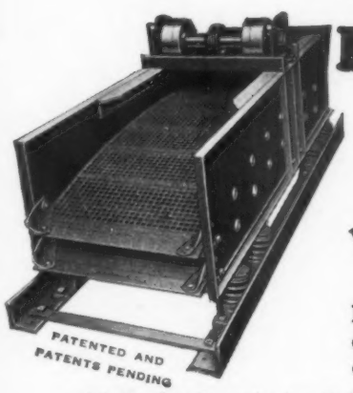

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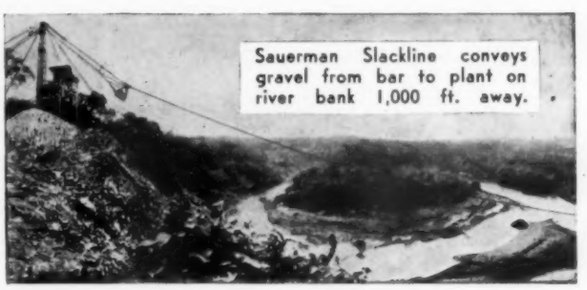

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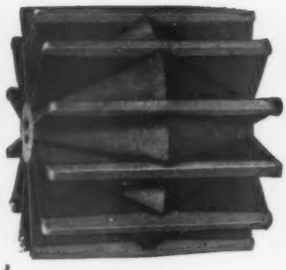

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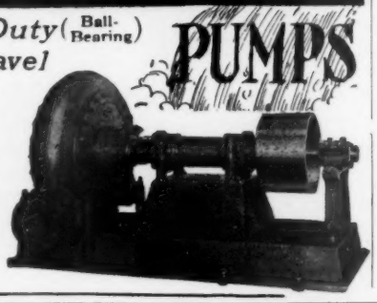

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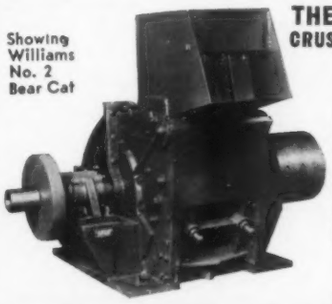
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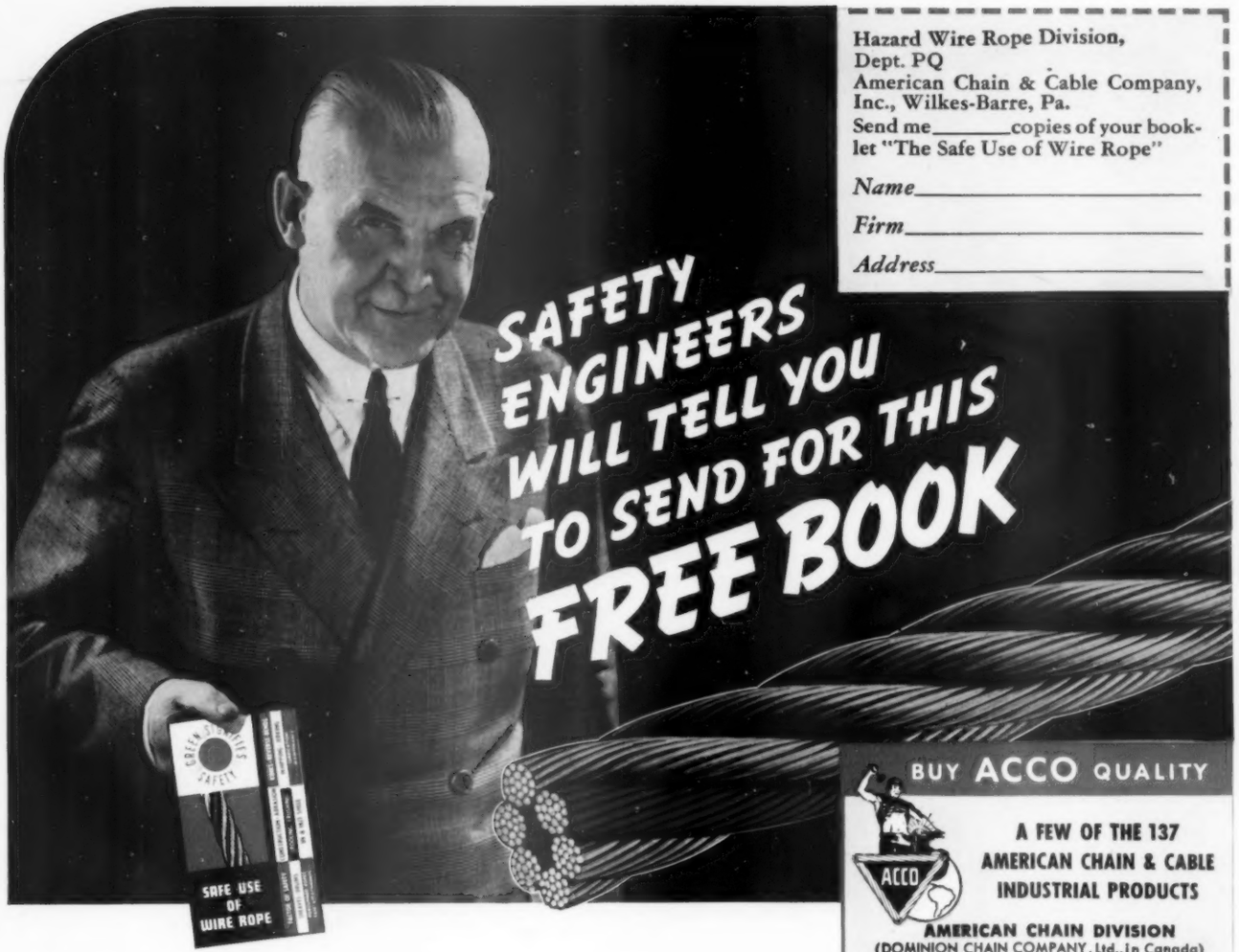

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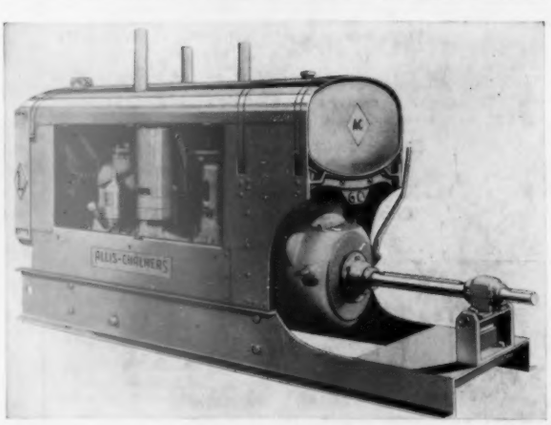

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